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UNITED STATES ARMY MEDICAL BIOENGINEERING RESEARCH & DEVELOPMENT LABORATORY

FORT DETRICK, FREDERICK, MD. 21701-5010

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REPORT MEDDH-288 (R1)

ANNUAL PROGRESS REPORT
1 October 1984 - 30 September 1985

VOLUME 1

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V O L U M E 1

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US ARMY MEDICAL BICENGINEERING RESEARCH AND DEVELOPMENT LABORATORY ANNUAL PROGRESS REPORT FY85, VOLUME 1

US ARMY MEDICAL BIOENGINEERING RESEARCH AND DEVELOPMENT LABORATORY
Fort Detrick
Frederick, MD 21701-5010

1 October 1985

Annual Progress Report for Period 1 October 1984 - 30 September 1985

US ARMY MEDICAL RESEARCH AND DEVELOPMENT COMMAND
Fort Detrick
Frederick, MD 21701-5012

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Annual Progress Report, Fiscal Year 1985, summarizes in two volumes the research performed by the US Army Medical Bioengineering Research and Development Laboratory in projects authorized by The Surgeon General, the US Army, and the Commander, US Army Medical Research and Development Command, and supported by RDTE funds from the US Army Medical Research and Development Command.		

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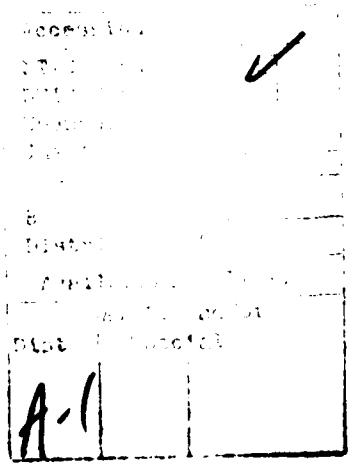
Chemical Hardening of Medical Equipment, Patient Dosimeter, Resuscitation Devices, Chemical Agent Identification/Quantitation, Vector Control Methods, Field Medical Refrigeration Equipment, Field Sterilization Equipment, Medical Grade Water, Field Guerney, Noninvasive Vital Sign Monitors, Controlled Release Pesticides, Microbial Fate, Organic Chemistry, Environmental Biology, Inorganic Chemistry, Hygiene, Environmental Container, Field Oxygen Generation, Teleradiography, Foreign Medical Materiel, Environmental Modelling, Inhalation Toxicology, Teratology



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INTRODUCTION

This past year at the US Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) has been one of dynamic change accompanied by a proactive approach to the mission responsibilities of the organization. During the year the Laboratory began to accelerate its systems management of medical materiel development and in so doing gained higher visibility and enhanced credibility throughout its chain of Command and within the AMEDD community. The program in health effects research provided outstanding comprehensive support to major efforts within the Army Medical Department, the Army Materiel Command and the Department of Defense. More effective review, analysis and planning are currently receiving major comprehensive emphasis, and coupled with this year's minor reorganization we expect to meet or exceed all of our annual objectives.

The first requirement for constructing the USAMBRDL program is to assess the highest priority military-relevant threats. From this refined list available resources are applied in priority based on considerations of the severity of the threat and the scientific feasibility of developing improved medical defenses against that threat. To that end several management initiatives have been put in place to firmly support the Laboratory in its productivity and long-range approach to our research and development efforts. A Strategic Planning Conference, laboratory upgrades, judicious equipment and property acquisition, a viable Technology Transfer program, comprehensive in-house information exchange, and effective liaison activities with Command laboratories and other collaborating organizations within the Department of the Army, Department of Defense and civilian community, have all served well to enhance the USAMBRDL's efficiency.

A major impediment to the program is the continued complexity of the contracting process. The substantial delay between the submission of contracting documents and the initiation of programs has a severe impact on obligation and disbursement rates. This effect, coupled with a Continuing Resolution Authority only serves to further confound attempts to manage fiscal resources prudently.

This Laboratory's interface with the US Army Medical Materiel Development Activity (USAMMDA) is in the growth phase. Issues concerning the transition of products from the technical base through advanced and engineering development and the concommitant responsibilities for fielding are being addressed forthrightly.

Personnel management was outstanding even though the Laboratory was subjected to manpower decrements during the Fiscal Year. A well thought-out approach to this issue, and clear guidance is clearly necessary to avoid deterioration of programs which are tying planning objectives to adequate but austere personnel support.

In summary, this year was a highly productive and eventful one for the USAMBRDL. The realignments implemented in program emphasis were in response to guidance from higher headquarters and emerging new information. As the majority of our programs are multidisciplinary and carried out by many investigators over several years, the material covered by this annual report will provide only an insight of the overall program and its progress. Total program progress is the result of the combination of the in-house effort augmented and supplemented by efforts by contractors from academia and industry.

Trends and accomplishments are highlighted in Volume 1 of this report while all research and technology summaries (1498s) are presented in Volume 2. Detailed individual and contractor's research is synopsized in reports which are filed with the Defense Technical Information Center (DTIC).

Questions or comments about this report are welcomed and may be addressed to the Commander, USAMBRDL.

CARL E. PEDERSEN, Jr., Ph.D.
Colonel, MS
Commanding

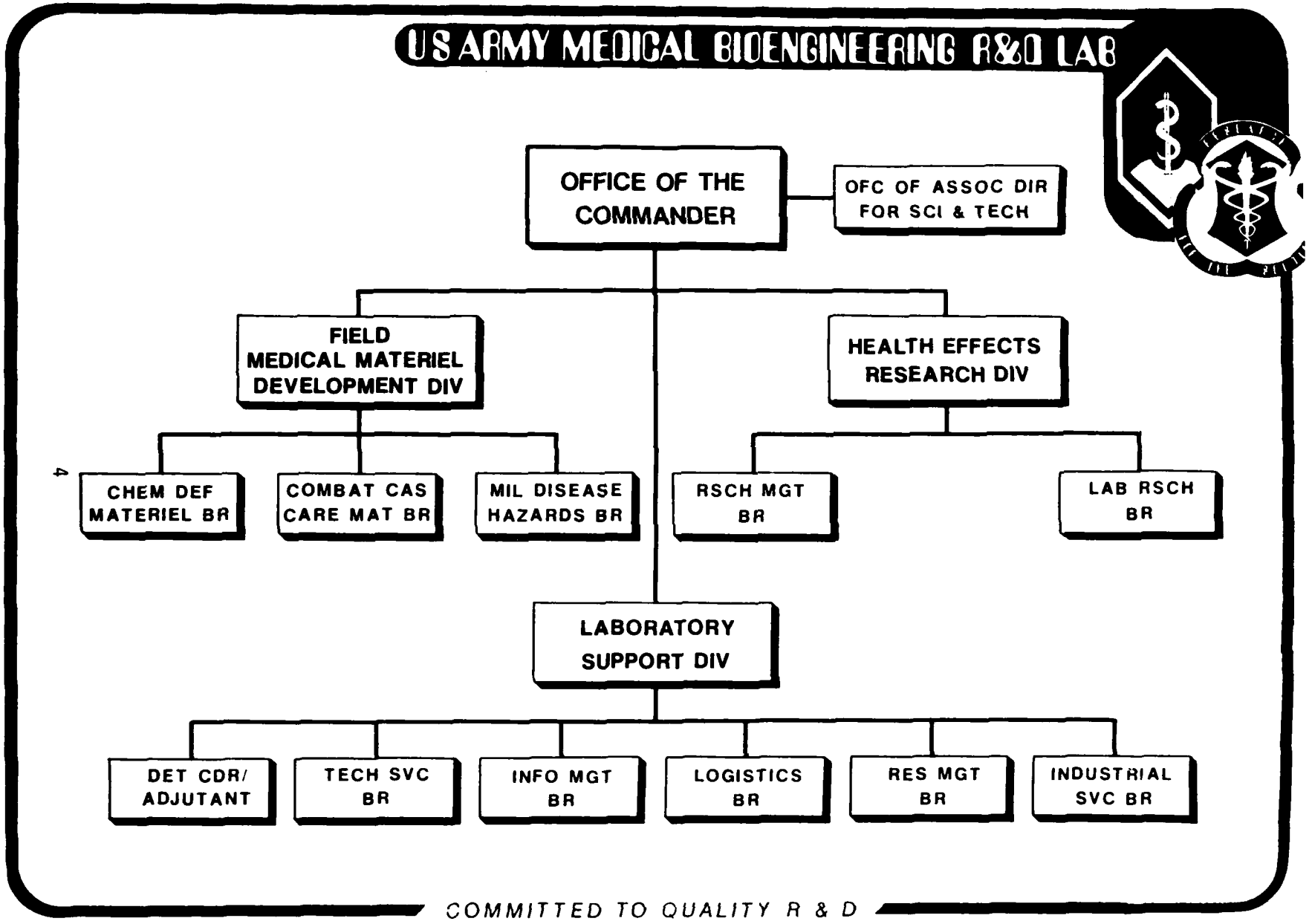
US ARMY MEDICAL BIOENGINEERING R&D LAB

PURPOSE

The United States Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) serves the needs of the soldier in the field through Research and Development to enhance Preventive Medicine and Medical Equipment Capabilities, and to address Environmental and Occupational Health concerns related to Chemical Substances from Army Industrial and Field Operations.

MISSION

The United States Army Medical Bioengineering Research and Development Laboratory (USAMBRDL) conducts basic research in the areas of field medical materiel, vector control systems, health hazard assessments and environmental health effects. It also develops or modifies, tests, and evaluates field medical, dental and water treatment equipment and technologies, as well as develops vector control and field sanitation methods, materials and equipment to meet military needs. The Laboratory establishes atmospheric and water related health hazard data bases for occupational and field exposures to chemicals and microorganisms and provides exposure guidance and recommends criteria and develops and recommends environmental criteria and pollution abatement procedures for chemical substances from Army industrial and field operations. In addition, USAMBRDL provides research, consultation and technical services to the Army and other federal agencies as requested.


US ARMY MEDICAL BIOENGINEERING R&D LAB
OFFICE OF THE COMMANDER
OFC OF ASSOC DIR FOR SCI & TECH
FIELD MEDICAL MATERIEL DEVELOPMENT DIV
HEALTH EFFECTS RESEARCH DIV
CHEM DEF MATERIEL BR
COMBAT CAS CARE MAT BR
MIL DISEASE HAZARDS BR
RSCH MGT BR
LAB RSCH BR
LABORATORY SUPPORT DIV
DET CDR/ ADJUTANT
TECH SVC BR
INFO MGT BR
LOGISTICS BR
RES MGT BR
INDUSTRIAL SVC BR
COMMITTED TO QUALITY R & D

MANAGEMENT INITIATIVES

The USAMBRDL undertook several management initiatives during the course of the year. The following briefs represent the strategic and innovative approach which characterizes the direction taken. These are not cited in any particular priority; however, collectively, they demonstrate an official proactive attitude toward the long range and away from standard, reactive short-term methods.

In February of this year, the Organizational Effectiveness Office at Fort Detrick, Frederick, Maryland, coordinated a Strategic Planning Conference for the Commander and the staff. The four day planning conference was very intensive and focused on the purpose, goals, objectives, and tasks for the laboratory. These objectives were articulated in a working document which was published and distributed to all staff members. A Steering Committee was formed to follow up on these objectives and ensure that each staff member had an opportunity to read them, ask questions, and contribute their own ideas to the document. The process will result in a written RDT&E plan for the USAMBRDL.

The acquisition and disposal of property were two key management issues during 1985. One approach represents modernization and the other represents a direction away from traditional values. During FY85, excess equipment was either recycled to allied research institutes or turned in for Disposal. New laboratory and management equipment acquired during the year represented efforts to maintain the highest level of equipment technology and to replace marginally effective items in the shop and on the bench.

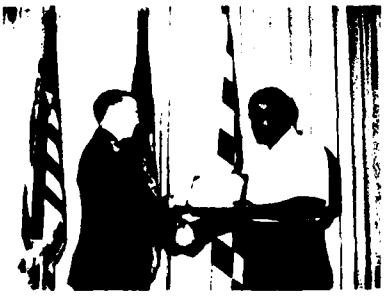
The institutional approach to domestic technology transfer was administratively improved during FY85. The duties associated with technology transfer were shared by the Deputy Commander and the Executive Officer. The program was carefully reviewed and shortcomings were identified. Technology transfer tasks were added to the performance standards for many bench scientists, engineers, and branch chiefs. The technology transfer duties (Office of Research Technology Assessment) and oversight will be vested in a Quality Assurance Manager as soon as the recruiting process brings one on board. During 1985, fifty-seven Domestic Technology Transfer actions were performed by the scientific and engineering staff and 650 manhours were dedicated to domestic technology transfer. Such actions included conferences, seminars, and meetings to which commercial or academic concerns were invited, information meetings attended by state and local officials, and visits by officials from organizations such as regional fish and wildlife activities, state agricultural offices, and state and local task forces representing environmental concerns. The USAMBRDL also took a more active role in regional and national affairs sponsored by the Federal Laboratory Consortium.

The successful Scientific and Engineering Symposia initiated during 1984 were continued in 1985. This year critical management and administrative topics were introduced to fully integrate the scientific, engineering and management efforts of the staff.

During September of this year, the Commander initiated a comprehensive Review and Analysis of all laboratory programs. This intensive review included in-house programs, extramural programs, and the administrative programs for the laboratory. Division, Branch, and Team Chiefs moderated the presentations which outlined programs, projects, contracts, methodologies, and technologies. This was a major undertaking which was designed to evaluate the performance of contractors, principal investigators, contracting officers technical representatives, and managers with an eye toward improving total laboratory program execution. This Review and Analysis will be the capstone for our comprehensive R&D planning process.

During 1985, there was a laboratory reorganization which shifted personnel assets into a more effective functional arrangement. A Technical Services Branch was created to provide single management focus for support services to include safety, graphic arts, and the technical library. The fabrication facility was redesignated the Industrial Services Branch and placed under the organizational supervision of the Executive Officer.

Additionally, a people oriented approach to team building throughout FY85 was implemented. Picnics, softball games, tugs-of-war, egg tosses, feasts on crabs and other seafoods as well as a multitude of varied celebrations for promotions, successful projects completion, births of babies, birthdays, weddings, adopted suggestions and well deserved awards and decorations.



PROGRAM FUNDING

In-house Laboratory operations are financed with Program 6 (RDTE) direct funds from Headquarters, US Army Medical Research and Development Command (USAMRDC), and reimbursable funds from Army and other DOD customers. Execution of the FY85 program resulted in an obligation rate of 92.0% and a disbursement rate of 67.7%, exceeding the obligation and disbursement targets established by higher headquarters. In FY84, purchases of special purpose items created a one-time surge in expenditures with the FY85 program moderating to a normal growth pattern. In FY86, an intensive review of in-house program execution resulted in realignment of on-going research between the separate program technical areas of 6.1 through 6.5. FY86 extramural estimates are based upon requirements to continue present programs at current levels. Actual funding for contractual efforts will be approved by HQ, USAMRDC.

FUNDING ($000)
IN-HOUSE

Program	FY84	FY85	FY86
6.1 Research	488	363	724
(ILIR)	(100)	(70)	(113)
6.2 Exploratory Development	3,778	3,899	3,532
6.3 Advanced Development	839	804	687
6.4 Engineering Development	561	887	910
6.5 Management and Support	224	213	294
Customer Funded	469	367	246
TOTAL	6,379	6,533	6,393
	EXTRAMURAL		
Contract	18,559	13,852	13,473

PERSONNEL

Civilian Awards. Five USAMBRDL employees received quality steps increases; seven received Sustained Superior Performance Awards; six received Special Act Awards; nine received Significant Accomplishment Awards; five received PMRS Performance Awards; one received the Commander's Award; and one scientist, Dr. Stephen Schaub, received the Meritorious Civilian Service Award.

Civilian Turnover. Civilian losses resulted in a 15% personnel turnover during the year. Timely personnel gains resulted in actual personnel strength of 100% of authorizations on 30 September 1985.

Time Saved. USAMBRDL employees averaged 50 hours of sick leave usage during FY85, below the DA objective of 57 hours per employee.

Equal Employment Opportunity. In addition to initiations in the handicapped program, USAMBRDL hired 1 Hispanic, 4 females, 1 female summer faculty participant, 7 female students under various programs, and promoted 4 female employees.

Military Awards. During FY85, military personnel assigned to USAMBRDL received one Meritorious Service Medal, five Army Commendation Medals, and three Army Achievement Medals.

Military Promotions. Seven soldiers assigned to the Laboratory during the fiscal year achieved promotions to the following pay grades: E5, two; E4, four; E3, one.

Military Turnover. 37% of assigned military departed the Laboratory either for reasons of permanent change of station or for having reached the end of their military obligation. With eight arrivals, there was a total loss of 3 military from the prior Fiscal Year. At the end of FY85 100% of all military authorizations were filled.

PROGRAMS

DOD Science and Engineering Program. This program is sponsored jointly by the DOD and the University of the District of Columbia and provides a substantive work experience for bright young high school students in the fields of science and engineering. USAMBRDL utilized seven students at no salary expense as the students are volunteers in a learning capacity.

Summer Hire Program. This program gives the Laboratory the ability to hire temporary, general schedule employees to work for the summer in areas of computer science, accounting technician, biological aid technician, engineering draftsman and physical science aid/technician. This is in addition to the usual summer hire clerical positions. Two were hired in the Laboratory in FY85.

Stay-In-School and Summer Aid Programs. USAMBRDL employed six students in FY85 in the stay-in-school program, designed to pay disadvantaged high school and college students minimum wage to help meet their in-school expenses.

Handicapped Student Program. USAMBRDL employed one handicapped career government employee and two Maryland School for the Deaf handicapped students as student aids in FY85. Vehicle parking and safety and personal necessity items were made available to these employees.

Voluntary Program. Two people working towards their Masters Degree participated in this unpaid program, giving them the benefit of work experience.

Student Contract Program. USAMBRDL employed six students in this DOD-implemented program to allow the hiring of part-time or full-time post-secondary school students to perform temporary or intermittent technical services at Department of Defense Research and Development Laboratories.

Faculty Research and Engineering Program, Battelle, Columbus Laboratory. One university (Ph.D.) and three high school faculty members spent several weeks at USAMBRDL this summer that enabled them to spend time in a research environment and give the Laboratory the benefit of their expertise.

Laboratory Research Cooperative Program, Battelle Columbus Laboratory. One college student from West Virginia University spent several weeks at USAMBRDL this summer to support a scientist in the diagnoses of histopathologic and carcinogenic lesions in fish used in in-house testing and to evaluate proposed carcinogen testing protocols using fish which have been developed through in-house research efforts.

PROGRAMS/PERSONNEL
FY85

	Authorized	On Board	Doctorate	Masters	Bachelors
Military	30	30	2	13	10
Civilian	92	92	17	10	20
Total	122	122	19	23	30

PROFESSIONAL ASSOCIATIONS AND COMMITTEES

Academy of Toxicological Sciences
American Animal Hospital Association
American Association for the Advancement of Science
American Association of University Professors
American Chemical Society
American College of Toxicology
American Conference of Government Industrial Hygienists
American Institute of Chemical Engineers
American Institute of Chemists
American Mosquito Control Association
American Public Health Association
American Society for Mechanical Engineers (Bioengineering Section)
American Society for Microbiology
American Society for Testing and Materials (E-35 on Pesticides) and (E-29 on Particle Size Measurement)
American Water Works Association
American Veterinary Medical Association
Armed Forces Pest Management Board (Equipment Committee) and (Medical Entomology Committe)
Association of the Advancement of Medical Instrumentation
Association of Military Surgeons of the United States
Association of Official Analytical Chemists
Association of the Operating Room Nurses (AORN), Associated Standards Subcommittee and Technical Practices Coordinating Committee
Association of Scientists of Indian Origin in America
Beta Kappa Chi Scientific Honor Society
Biochemical Society, London
Chemical Society of Washington, DC
Ecological Society of America
Entomological Society of America
Entomological Society of India
Environmental Mutagen Society
Federal Laboratory Consortium
Genetic Society of America
Genetic Toxicology Association
Indian Science Congress
Lepidoptera Research Foundation
National Environmental Health Association
New York Academy of Sciences
Phi Lambda Upsilon
Research Society of America
Royal Chemical Society
Sigma Xi
Society of American Inventors
Society of Automotive Engineers
Society of Environmental Toxicology and Chemistry
Society of Toxicology
Tau Beta P. Honorary Society for Engineers
The American Fisheries Society
The Lepidopterists' Society
The Virginia Water Pollution Control
Tissue Culture Association
Water Pollution Control Federation

FIELD MEDICAL MATERIEL DEVELOPMENT DIVISION

The Field Medical Materiel Development Division (FMMDD) conducts engineering research and development of medical equipment for the Army; research and development are also provided for the Navy and Air Force as required. The division also conducts The Army Surgeon General's Research, Development, Test, and Evaluation (RDTE) program in integrated vector control systems which includes materials, methods, equipment, and concepts.

The Office of the Chief directs three branches by establishing overall program priorities, providing guidance, and allocating all resources for program execution. It provides the formal management structure for actions relative to the Life Cycle Systems Management Model and provides engineering, drafting, and editorial services for the division.

The Combat Casualty Care Branch conducts in-house and extramural research and development of field materiel relative to treatment of combat casualties. It works closely with Research Area II, US Army Medical Research and Development Command (USAMRDC), serving research and development needs for combat casualties.

The Chemical Defense Materiel Branch conducts in-house and extramural research and development for materiel relative to the medical defense against chemical warfare agents. It works closely with Research Area V, USAMRDC, serving research and development needs for chemical defense.

The Military Disease Hazards Branch supports The Surgeon General's responsibilities in disease vector control methods, material, equipment, and systems RDTE. Through extramural and in-house research it develops vector control equipment and systems for military requirements. It maintains laboratory colonies of arthropods for in-house research for use as biological indicators for chemical and biological control studies.

COMBAT CASUALTY CARE PROGRAM

Combat Casualty Care Program provides The Surgeon General with specialized or improved medical equipment which fill recognized military requirements.

COMBAT CASUALTY CARE TASKS

FILMLESS RADIOLOGY (DIGITAL IMAGING)

Objective: To develop a digital radiographic-fluoroscopic information handling system for use in the field.

Military Relevance: To decrease the logistical burden associated with the use of conventional film X-ray systems (eliminating film, film processors, chemicals, and water), to improve the resolution of images, and to decrease the exposure time of the patient to X-rays.

Progress: A 1-inch diameter viewing system (detector) and the system which transfers the radiographic information telephonically were developed and a preliminary evaluation at the Uniformed Services University of the Health Sciences (USUHS), Bethesda, MD, was completed. Data collection and interpretation are finished. Preliminary results were presented at a conference held in August 1985. The final written report is being completed. A new proposal has been submitted by USUHS to develop a two unit test bed/training system and subject it to a 4-year trial.

In-House Work Unit: Digital Radiography, DA0G9204, US Army Medical Bioengineering Research and Development Laboratory (Salisbury, L. L.).

Contract: Filmless Radiology (Digital Imaging), DA303237, Uniformed Services University of the Health Sciences School of Medicine (Brahman, S. L.); Salisbury, L. L.

FLYWHEEL POWERED MOBILE X-RAY GENERATOR WITH FLUOROSCOPIC CAPABILITY

Objective: To develop a flywheel-powered, mobile X-ray system that has the capability to produce both radiographic and fluoroscopic images for clinical and field use.

Military Relevance: To develop a smaller, more efficient, mobile field system capable of producing both radiographic and fluoroscopic images, thus reducing electrical energy demands.

Progress: An experimental prototype having radiographic and fluoroscopic capability was delivered 17 September 1985 and is undergoing evaluation. The final report will be completed by end of 4Q85.

Contract: Flywheel-Powered Mobile X-Ray Generator with Fluoroscopic Capability, DA0G9379, Instrumentation Systems Center, University of Wisconsin (Siedband, M. P.); Salisbury, L. L.

IMPROVED RADIOGRAPHIC VIEWING SYSTEM

Objective: To develop an improved, high resolution detector that digitalizes radiographic images.

Military Relevance: To improve the resolution of images, to decrease the exposure time of the patient to X-rays, and to decrease the logistical burden involved with the use of conventional film X-ray systems (eliminating film, film processors, chemicals, and water).

Progress: A 1-inch diameter, high resolution viewing system (detector) was delivered, and evaluation of the demonstration model was positive. A Request for Proposal (RFP) for a full size model is being prepared and will be released as soon as funds become available.

In-House Work Unit: Digital Radiography, DA0G9204, US Army Medical Bioengineering Research and Development Laboratory (Salisbury, L. L.).

Contract: An Improved Radiographic Viewing System, DA301080, Huntsville Electronics Division, Chrysler Corporation (George, E. W.); Salisbury, L. L.

FAMILY OF MEDICAL EQUIPMENT PROTECTION CONTAINERS

Objective: To design, fabricate, and evaluate a set of strong, lightweight containers for fragile medical equipment that is presently authorized to field medical units.

Military Relevance: To reduce repairs and maintenance manpower time by assuring that fragile medical equipment is protected during handling, shipping, and storage.

Progress: The US Army Medical Materiel Development Activity (USAMMDA) had previously requested that USAMBRDL expend no further effort on this project until an In-Process Review (IPR) could be convened. Information has been provided to USAMMDA for use in preparing an IPR packet. The IPR is scheduled for 10 October 1985.

In-House Work Unit: Family of Medical Equipment Protective Containers, DA0B6248, US Army Medical Bioengineering Research and Development Laboratory (Reams, W. H.).

ON-SITE MEDICAL OXYGEN GENERATING AND DISTRIBUTION SYSTEM

Objective: To develop a system that will produce medical grade oxygen in the field.

Military Relevance: To reduce the logistical burden of supplying large numbers of high pressure gas cylinders needed to treat combat casualties.

Progress: Three contracts were awarded on 6 March 1985 for production of prototypes for the demonstration and validation phase. Preliminary design of the system is nearly complete. After evaluation and testing of the prototypes, the best system will be selected for full-scale development.

In-House Work Unit: On-Site Medical Oxygen Generating and Distribution System, DA0G9210, US Army Medical Bioengineering Research and Development Laboratory (Thayer, C. R.).

Contract: Development of a Field Medical Oxygen Generating and Distribution System, DA306682, Clifton Precision (Tiegland, S. R.); Hathaway, C. C.

RESUSCITATION FLUIDS PRODUCTION AND RECONSTITUTION SYSTEM

Objective: To develop a system that will produce on-site medical grade water for injection from a potable water source.

Military Relevance: To reduce the significant logistical burden of supplying prepackaged and premixed sterile solutions for injection that are necessary to treat casualties in combat areas.

Progress: An RFP was issued during 1Q85 with responses due in May 1985. A Source Selection Board met 5-7 June 1985 to select one or more vendors to produce prototypes. Facilities of potential contractors were visited and evaluated 28-29 June through 3 August 1985. Revised proposals from potential contractors were submitted and reviewed. Two potential contractors have been selected from a field of four. The final selection will be made and a contract let early in 1Q86.

In-House Work Unit: Resuscitation Fluids Production and Reconstitution System, DA0G9206, US Army Medical Bioengineering Research and Development Laboratory (Conway, W. H.).

CARRIER, LITTER, WHEELED

Objective: To provide a carrier device that facilitates patient transportation over various types of terrain and inside field hospitals.

Military Relevance: A reduction in the the number of personnel required to transport litter patients in the field and in fixed facilities will increase the availability of personnel assets for other duties.

Progress: An IPR held in December 1984 selected USAMBRDL's version for type classification. The Technical Data Package was completed and transitioned to USAMMDA during 3Q85. A production and deployment contract will be awarded by USAMMDA.

In-House Work Unit: Carrier, Litter, Wheeled, DA0G5856, US Army Medical Bioengineering Research and Development Laboratory (Thayer, C. R.).

ETHYLENE OXIDE STERILIZATION (EOS) SYSTEM

Objective: To develop a sterilization system that will provide a fast, reliable, efficient ethylene oxide sterilization capability for field hospitals.

Military Relevance: No reliable field sterilization system exists for the preparation of reusable heat-labile medical equipment, especially plastic and rubber goods. Large quantities of such goods are already in field hospitals. Being able to reuse goods intended for one-time use would decrease logistical support. Ethylene oxide sterilization is the only fast, reliable, and efficient method to sterilize heat and pressure-sensitive medical items and is necessary for Table of Organization and Equipment hospitals.

Progress: In-Process Review decisions in 2Q85 retained task in full-scale development phase and placed it on hold pending a General Officer IPR to decide flexibility of ethylene oxide. A nongovernment independent firm is presently investigating the best technical approach on mechanical relays versus solid-state circuitry. A purchase request and justification were forwarded to the US Army Medical Research Acquisition Activity (USAMRAA) to obtain the original drawings from the American Sterilizer Company (AMSCO). These drawings will be reviewed and revised as necessary to reflect the as-tested configuration of the sterilizer. An RFP is being written to award a contract for six full-scale development prototypes.

In-House Work Unit: Ethylene Oxide Sterilization (EOS) System, DA0G9320, US Army Medical Bioengineering Research and Development Laboratory (Arnold, M. F.).

STEAM VACUUM PULSE STERILIZER (SVP) SYSTEM

Objective: To develop a sterilization system which will provide a fast, reliable, efficient, automatic item sterilization capability in field hospitals.

Military Relevance: The substitution of a larger, faster, more efficient, and more reliable steam vacuum sterilizer system will improve support in field hospitals.

Progress: In-Process Review decisions in 2Q85 retained task in full-scale development phase and called for a review of converting relay control logic to microprocessor technology and for Operational Test IIa. Review of electronics is under way. A nongovernment independent firm is presently investigating the best technical approach on mechanical relays versus solid-state circuitry. A purchase request and justification were forwarded to USAMRAA to obtain the original drawings from AMSCO. These drawings will be reviewed and revised as necessary to reflect the as-tested configuration of the sterilizer. An RFP is being written to award a contract for six full-scale development prototypes.

In-House Work Unit: Steam Vacuum Pulse Sterilizer (SVP) System, DA0G9318, US Army Medical Bioengineering Research and Development Laboratory (Arnold, M. F.).

LINER, HEATED PATIENT HOLDING AND EVACUATION SYSTEM

Objective: To develop a heated liner that can be inserted in the current insulated evacuation bag. The combination will maintain desired, controlled temperatures in extremely cold climates for prolonged period.

Military Relevance: To protect and prevent additional complications to casualties awaiting or being transported through the evacuation process in extremely cold climates.

Progress: A contract to design a propane pressure regulator to operate at -50°F was cancelled. A Norwegian charcoal unit is being pursued as the main effort. Initial tests of a Norwegian heater system are promising. The system is charcoal fueled and uses a battery powered fan to circulate warm air through a mattress and auxiliary tube assembly. Additional tests are planned at the US Army Research Institute of Environmental Medicine (USARIEM) using an instrumented, copper mannequin. Changes to the current evacuation bag will be recommended to improve its insulative quality. A commercial bag is also being evaluated as a substitute for the current bag.

In-House Work Unit: Liner, Heated, Patient Holding and Evacuation System, DA0A6282, US Army Medical Bioengineering Research and Development Laboratory (Rhodes, C. T.).

HIGH CAPACITY RADIOGRAPHIC SYSTEM FOR FIELD USE

Objective: To develop a modern, reliable, maintainable, transportable field medical radiographic and fluoroscopic system which is compatible with the military standard system.

Military Relevance: A modern, reliable system is needed to replace the present system to provide adequate health care.

Progress: A contract was awarded to Picker International for the production of 12 prototypes in 2 increments of 6 each. The first increment is scheduled for delivery in 4Q86 at which time two of the systems will be shipped to the Army Medical Department (AMEDD) for Operational Testing (OT). Development Testing is presently scheduled to start 1Q86 through 3Q86 at the contractor's site, with necessary shakedown at USAMBRDL during 4Q86; OT in 4Q86. A project review was held at Picker International 26-28 August 1985 to review status, schedules, test and evaluation plans, film screen combination, and to discuss high altitude electro-magnetic pulse (HAEMP) design. Engineering models have been built and tested by the contractor. Prototype design has begun.

In-House Work Unit: High Capacity Radiographic System for Field Use, DA0B6250, US Army Medical Bioengineering Research and Development Laboratory (O'Connor, R. J.).

Contract: Military Transportable Field Radiographic and Fluoroscopic System, DA304538, Picker International, Government Systems Group (Browne, D. W.); O'Connor, R. J.

REFRIGERATOR, MEDICAL FIELD

Objective: To develop or procure a lightweight, reliable, supportable medical field refrigerator to replace the current refrigerator.

Military Relevance: A biological refrigerator for the storage of perishable medical supplies is a necessity for field medical units.

Progress: The materiel developer has directed all contractual efforts for development of a field refrigerator to stop. This has occurred and the solicitation previously advertised has been cancelled. Renewal of development efforts is dependent on IPR decisions following review of the Academy of Health Sciences' (AHS) test results on a nondevelopmental item. In-house efforts have been terminated.

In-House Work Unit: Refrigerator, Medical, Field, DA0G0652, US Army Medical Bioengineering Research and Development Laboratory (O'Connor, R. J.).

CHEMICAL DEFENSE MEDICAL MATERIEL PROGRAM

Chemical Defense Medical Materiel Program addresses the development of equipment vital for medical treatment, evacuation, and decontamination of patients in a chemical warfare environment. The problems associated with chemical defense including protection of medical materiel from exposure to toxic agents are examined, and solutions are proposed, evaluated, and tested.

CHEMICAL DEFENSE MEDICAL MATERIEL TASKS

CHEMICAL HARDENING OF FIELD LITTERS

Objective: To improve the existing litter or design a new litter that is not degraded by chemical warfare agents or decontamination agents.

Military Relevance: Decontaminability is necessary so casualties and treatment personnel won't be further exposed to or recontaminated by chemical agents during evacuation and treatment.

Progress: Screening tests of candidate materials by the Chemical Research and Development Center (CRDC), Aberdeen Proving Ground, MD, identified polyethylene as the best material to use for the cover and handles. Further testing will be done by Battelle Memorial Institute, Columbus Laboratories, through a contract with the US Army Medical Research Institute of Chemical Defense (USAMRICD), to quantify the agent resistance characteristics of polyethylene for this application. The effects of color dyes and fire retardant treatments on the material's agent resistance will be determined.

In-House Work Unit: Chemical Hardening of Field Litters, DA306622, US Army Medical Bioengineering Research and Development Laboratory (Reams, W. H.).

CHEMICAL HARDENING OF MEDICAL FIELD CHESTS

Objective: To chemically harden existing and future military medical field chests by increasing resistance to both chemical agents and decontaminating agents.

Military Relevance: The current medical chest is not resistant to chemical agents or decontamination solutions. The development of a chemically hardened chest is essential to permit the continued treatment of casualties with uncontaminated equipment and medical supplies on a chemical battlefield.

Progress: A prototype chemically hardened gasket is being tested at Dugway Proving Ground, UT, for resistance to chemical and decontaminating agents. Chests fitted with the new gasket and painted with the Department of Army approved chemical agent resistant coating will provide a near term improvement to the chemical resistance characteristics of the existing field medical chest. Results from testing at Dugway Proving Ground will also indicate whether additional efforts are required to improve handles and latches to further harden the chest.

In-House Work Unit: Chemical Hardening of Medical Field Chests, DA0G1513, US Army Medical Bioengineering Research and Development Laboratory (Patzer, N. H.).

Contract: Gasket Material, Rubber, Molded, Toxic Chemical Agent Resistant, DA303964, Crown Products Company (Blankenship, J. R.); Patzer, N. H.

CHEMICAL WARFARE AGENT, PROTECTIVE FIELD BATTLE DRESSINGS

Objective: To provide field dressings to protect open wounds from chemical warfare agent contamination.

Military Relevance: The survivability of US Army casualties during chemical warfare must be increased; recontamination and secondary contamination must be prevented. Battle dressings which are impervious to chemical agents and incorporate antibiotic drugs will enhance casualty survivability.

Progress: A Joint Working Group, tentatively scheduled for 1Q86, will be convened by the AHS to prepare and approve a Joint Service Operational Requirement (JSOR) with the US Air Force and US Navy.

In-House Work Unit: Chemical Warfare Agent, Protective Field Battle Dressing, DA307168, US Army Medical Bioengineering Research and Development Laboratory (Malek, J. W.).

TECHNICAL FEASIBILITY TESTING OF FOREIGN MEDICAL MATERIEL FOR USE IN A CONTAMINATED ENVIRONMENT

Objective: To evaluate foreign medical materiel, technology, and doctrine for adoption to improve the US Army Medical Department (AMEDD) casualty management in contaminated field environments.

Military Relevance: The survivability of US Army casualties during chemical warfare must be enhanced. The acquisition of materiel and technology which are developed and proven will save time, money, and manpower.

Progress: A closer liaison has been established with the Armed Forces Medical Intelligence Center as a source for foreign medical materiel. Evaluation of the West German Decontamination System (GDS) is on hold pending inquiry into missing tentage and the status of this equipment in the German inventory. Preliminary evaluation of the Israeli Battalion Aid Station (IBAS) set has shown no novel equipment other than a folding litter. The assemblage is unique, however, in that it supports a physician at the battalion aid level. A plan has been prepared for evaluation of selected items of equipment from the French Parachutist Surgical Unit (FPSU) as a follow-on effort to an overall assessment of that unit during the past year.

In-House Work Unit: Technical Feasibility Testing of Foreign Medical Materiel for Use in a Contaminated Environment, DA0G1894, US Army Medical Bioengineering Research and Development Laboratory (Conway, W. H.).

MEDICAL STAFF CHEMICAL WARFARE AGENT DOSIMETER

Objective: To develop a small, individual dosimeter which will be sensitive to humanly undetectable but harmful, low concentrations of nerve and blister agent vapors and will alert medical staff members to these low exposure levels.

Military Relevance: This equipment is necessary to prevent medical personnel from being exposed to low levels of chemical agents and becoming casualties.

Progress: Two contractors have been chosen and contracts are expected to be awarded 1Q86. One contractor will pursue a gas chromatographic design and the other contractor will pursue an electrochemical design of the dosimeter.

In-House Work Units/Contracts: None

RESUSCITATOR/VENTILATOR, GAS-POWERED, INDIVIDUAL

Objective: To develop a gas-powered resuscitator-ventilator for resuscitating chemical warfare casualties by field medical personnel.

Military Relevance: On the integrated battlefield, chemical casualties will represent the greatest burden to the medical treatment system. This resuscitator-ventilator will reduce this burden by providing automated medical life support procedures to conserve scarce medical manpower and possibly provide a more effective means of resuscitating casualties.

Progress: USAMBRDL conducted engineering tests on joint Air Force/US Army Medical Research and Development Command test models. Efforts are under way to clarify requirements and prepare the JSOR; Academy of Health Sciences is the action office. Operational and Organizational Plan is currently being staffed worldwide by AHS. The Joint Working Group and Validation IPR are to be held the second week in December 1985. The JSOR is to be approved by end of 1Q86.

In-House Work Unit: Resuscitator/Ventilator, Gas-Powered, Individual (GPV), DA303504; US Army Medical Bioengineering Research and Development Laboratory (Malek, J. W.).

TECHNICAL FEASIBILITY TESTING (TFT) OF DELIVERY SYSTEMS FOR CHEMICAL WARFARE MEDICAMENTS

Objective: To determine, by market search, the best method or appliance to contain and deliver chemical warfare medicaments.

Military Relevance: The individual soldier must be issued those medicaments required to sustain his life in the event he in affected by chemical agents. The most effective container or delivery system must be provided.

Progress: Test units (Mark II autoinjectors) were received during 4Q85, and environmental testing is under way. Field evaluation will be delayed until early FY 86.

In-House Work Unit: Technical Feasibility Testing (TFT) of Delivery Systems for Chemical Warfare Medicaments, DA0G2702, US Army Medical Bioengineering Research and Development Laboratory (O'Connor, R. J.).

NBC WARFARE PATIENT NONINVASIVE (HEART RATE) SURVIVAL MONITOR

Objective: To develop a device which will allow an aidman to detect the heart rate of an NBC (Nuclear Biological Chemical) casualty through chemical protective garments at field combat locations.

Military Relevance: To allocate the optimum medical resources, each aidman will use heart rate information to triage casualties rapidly.

Progress: The three contractors identified below delivered breadboard prototypes. Engineering tests indicate that approaches will not satisfactorily meet the Army's requirements. A Statement of Work has been prepared and submitted to USAMMDA to use in preparing an RFP to develop a simpler heart rate monitor. The contract will be phased to allow flexibility of approach.

Contracts: Noninvasive Heart Rate Monitor, DA300494, RCA Laboratories, David Sarnoff Research Center (Nowogrodzki, M.); Thayer, C. R.

Noninvasive Chemical Casualty Vital Signs/Heart Rate Monitors, DA301115, Decision Science, Inc. (Halvorsen, K. G.); Thayer, C. R.

Noninvasive Heart Rate Monitor, DA300486, Industrial and Biomedical Sensors Corporation (Chang, K-W); Thayer, C. R.

NONINVASIVE NBC WARFARE PATIENT VITAL SIGNS MONITOR

Objective: This task is aimed at developing a device which will allow an aidman to detect the vital signs (heart rate, blood pressure, respiration, and tidal volume) of an NBC casualty noninvasively through chemical protective garments at field combat locations.

Miltary Relevance: Chemical warfare will generate a nearly unmanageable number of casualties. To allocate the optimum medical resources, each aidman will use the vital signs information to triage casualties rapidly.

Progress: Prototypes and all deliverables required by the contract were received. The contract has been completed. Prototypes were determined to be adequate to perform the required functions but were too large and too heavy. A new contract is currently being negotiated to address reduction in weight and cube. This reduction could be accomplished by incorporating newer liquid crystal diodes and by deleting the requirement for a hard copy printer.

Contract: Noninvasive Chemical Casualty Vital Signs Monitor, DA301113, GMS Engineering Corporation (Samaras, G. M.); Thayer, C. R.

RESUSCITATION DEVICE, INDIVIDUAL, CHEMICAL

Objective: To design and develop a manually operated, compact, lightweight medical device which can be operated by an individual soldier to ventilate chemical warfare agent casualties during their initial, forward treatment.

Military Relevance: Immediate resuscitation of chemical casualties is one of the vital life support treatments required for a nerve agent casualty.

Progress: The contract with Mine Safety Appliances Research Corporation was concluded with delivery of 100 units that met fabrication requirements. These models successfully completed Development Testing I. A Concept Evaluation Program (CEP) test, which will be conducted by the AMEDD Board, is scheduled for November 1985. Test models and cricothyroid cannula simulators were shipped to the AMEDD Board for the CEP test. A Safety Assessment Report with a Safety Release Statement based on contractual, engineering, and development tests has been completed. A Test Evaluation Master Plan has been completed.

In-House Work Unit: Resuscitation Device, Individual, Chemical, DAOG1512, US Army Medical Bioengineering Research and Development Laboratory (Malek, J. W.).

Contract: Resuscitation Device, Individual, Manually Operated, Field, DA303070, Mine Safety Appliances Research Corporation (Rankin, R. L.); Malek, J. W.

CHEMICAL WARFARE AGENT, PROTECTIVE PATIENT WRAP

Objective: To develop a chemical warfare agent protective patient wrap which protects decontaminated casualties from all known chemical agents during evacuation in a field environment.

Military Relevance: The survivability of casualties during chemical warfare is essential. The protective patient wrap is necessary to prevent recontamination and death of decontaminated casualties awaiting evacuation.

Progress: Agent tests on samples of the six candidate fabrics are continuing at Dugway Proving Ground, UT, as well as tests on the seams and closures to determine the best one to use for the final design. Initial test data indicate that the slide fasteners will be suitable closures. This closure is the one used on the chemical biological overgarment. An entire wrap made from the selected fabric and closure will be tested in the large chamber at Dugway Proving Ground using an instrumented mannequin. Respiratory protection testing was completed in June 1985 at the CRDC, Aberdeen Proving Ground, MD. Additional tests with treated carbon fabrics are planned for 1Q86 at CRDC. Physiological testing was completed June 1985 at USARIEM, Natick, MA. Two of the six candidate fabrics tested at USARIEM are better than the other four, and ongoing agent testing at Dugway Proving Ground is now focused on these two.

Contracts: Chemical Warfare Agent Protective Patient Wrap, DAOG7067, US Army Natick Research and Development Center (Snow, P.); Reams, W. H.

Chemical Agent Testing of the Chemical Warfare Agent Protective Patient Wrap, DA304534, US Army Dugway Proving Ground (Rice, W.); Reams, W. H.

Military Disease Hazards Program

Military Disease Hazards Program addresses development or modification of commercially produced vector control equipment, materials, and methods to satisfy the special mission requirements of the Army in the field.

Military Disease Hazards Tasks

VECTOR CONTROL SCIENCE BASE

Objective: To continually acquire a vector control science base, ensuring a steady stream of new, innovative, and often novel approaches for effective control of arthropod vector populations.

Military Relevance: Historically, the military has adopted pest control technologies long after they have been proven in the civil sector. This has caused a lag resulting in the military acquisition of outmoded technology in order to perform its mission to support the combat soldier. Attempting to combat vector-borne diseases with outmoded technology will result in inefficiency, wastefulness, and failure to carry out the mission.

Progress: Basic research has been conducted in the area of integrated pest management. Through extensive field research, the rotary wing aerial dispersal of selective insecticides with diluents was developed. Testing is continuing to determine the comparative effectiveness of diluted versus technical grade malathion for adult mosquito control. Bioassay methodologies involving sentinel mosquito cages are being examined using gas chromatography (GC) and the Army Insecticide Measuring System (AIMS).

In-House Work Unit: Vector Control Science Base, DA0G5997, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

VECTOR CONTROL METHODS, MATERIALS, EQUIPMENT

Objective: To develop threat projections, technological forecasts, and interagency planning to determine operational capabilities, doctrine, organization, and systems to meet Army vector control needs.

Military Relevance: Previous wartime experiences have demonstrated the devastating effect of outbreaks of arthropod-borne diseases on military operations. This task is aimed at providing the knowledge base for future investigations, formulating control concepts in early studies of systems, and evaluating experimental and commercial hardware. Identification and resolution of technical issues, operational issues, and logistical support problems are critical to the timely incorporation of new methodologies, materials, and equipment into the Army's vector control program.

Progress: Tests conducted in Panama confirmed that penetration of a double canopy jungle by liquid pesticides can be achieved. The pesticide was delivered by a multicapability, helicopter slung, pesticide dispersal unit at twice the standard rate of application. In FY 86, testing will further define the effectiveness of aerosol penetration through a double canopy and address specific methods of application. The multicapability, helicopter slung, pesticide dispersal unit was used in the first recorded effort to suppress ticks by aerial application. The test was conducted at Fort A. P. Hill, VA, with good results (greater than 50 percent reduction).

In-House Work Unit: Vector Control Methods, Materials, Equipment, DA0G8679, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

DELOUSING OUTFIT, POWER DRIVEN

Objective: To develop from standard military and commercial components a delousing outfit that is capable of dispensing pesticides accurately. It will be lighter, less bulky, and possess a more accurate dispersal system than the existing delousing outfit.

Military Relevance: Historically, louse-borne disease has caused an adverse impact upon the health, morale, and welfare of both military organizations and the civilian populace. The ability to control the vectors of louse-borne disease is of paramount importance to field medical and quartermaster personnel. The existing equipment is logistically unsupportable and cannot accurately dispense the new generation of louse control pesticides.

Progress: Based on discussions with The Surgeon General's Working Group on Pesticides and Pest Control Equipment, a six-gun delousing outfit will be designed. The recently procured guns will be redesigned concurrently with the mainframe development to produce a state-of-the-art delousing outfit.

In-House Work Unit: Delousing Outfit, DA303165, US Army Medical Bioengineering Research and Development Laboratory (Anderson, L. M.).

INTEGRATED PEST MANAGEMENT - BLACK FLIES

Objective: To develop methods of long-term suppression of immature stages of black flies and short-term suppression of adults without adverse effect of the environment.

Military Relevance: Currently, black flies seasonally restrict use of vast military training areas at some CONUS installations. In parts of Africa and Central and South America they are the primary vector of onchocerciasis or river blindness, a disease of military importance. Effective vector control strategies will permit increased military training at those installations and will reduce the potential threat of casualties due to onchocerciasis.

Progress: Requirements for testing larvicides with delayed or long-term activity (e.g., juvenile hormone analogues, controlled-release formulations) were delineated. Methods for meeting these requirements were developed. An improved static bioassay system for toxicity testing, a new static replacement bioassay system, and a flow-through system for rearing black fly larvae and testing larval control strategies were designed. All current and planned future developmental efforts overlap other program areas; therefore, a request for termination of the Letter of Agreement has been initiated.

In-House Work Unit: Integrated Pest Management - Black Flies, DA0B6244, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

INTEGRATED PEST MANAGEMENT - MOSQUITOES

Objective: To develop methods for mosquito control that integrate physical, chemical, and biological control methods to maintain effective control economically without undue damage to the environment. Baseline laboratory and field data on the efficacy of various insecticides for control of mosquito larvae will be collected and provided. Field application rates will be determined using this data.

Military Relevance: Troop casualties resulting from mosquito-borne diseases in conflicts prior to World War II exceeded combat related losses. Mosquito-related casualties in conflicts since 1950 have declined because of control efforts but remain a major threat to the success of combat operations in armed conflicts.

Progress: Testing and evaluation of a lightweight, gravity fed, battery operated, ultrasonic aerosol nozzle for ultra-low volume (ULV) pesticide dispersal are being conducted. Military Disease Hazards Branch personnel are participating in a joint Army/Air Force aerial application field test of two formulations of an oil-based biorational larvicide to determine the droplet size distribution and to evaluate the effectiveness of this method of application of Bacillus thuringiensis (serotype H-14). An aspirator has been developed to improve the efficiency of AIMS under conditions such as ULV aerosol spraying, in which droplets do not have enough velocity to impinge on the sensor wire. The aspirator has been tested under ground ULV aerosol dispersal conditions in a settling chamber; it will be tested under aerial dispersal conditions during the combined Army/Air Force field test. A paper on the development and field testing of the aspirator will be submitted for publication. A select group of entomologists will be convened to discuss and recommend future Integrated Pest Management programs.

In-House Work Unit: Integrated Pest Management - Mosquitoes, DA0G0649, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

PESTICIDE DISPERSAL EVALUATION SET

Objective: To develop a pesticide field evaluation set capable of measuring ultra-low volume (ULV) droplet spectra and total pesticide amounts applied by military dispersal equipment.

Military Relevance: Accurate calibration of dispersal equipment is essential for the effective and economical usage of ULV pesticide formulations in providing protection from disease for the soldier. The dissemination of droplets that are too large for effective control can produce adverse environmental effects. Droplets that are too small are ineffective and pose a potential health threat.

Progress: The droplet measuring device has been completed, and field hardening is under way through increasing the amount of printed circuitry and improving packaging. The unit has been formally named the "Army Insecticide Measuring System (AIMS)." A field hardened device is expected for testing by December 1985.

In-House Work Unit: Pesticide Dispersal Evaluation Set, DA0B6058, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

Contract: Measurement of Droplet Size Distributions in Insecticide and Herbicide Sprays, DA302779, KLD Associates (Mahler, D. E.); Boobar, L. R.

TECHNICAL FEASIBILITY TESTING OF VECTOR CONTROL EQUIPMENT

Objective: To determine the durability of commercially available ultra-low volume (ULV) and powered pesticide dispersal equipment by comparative engineering tests.

Military Relevance: New and improved commercial items are frequently presented to the DOD as potential standard items. Some are unfit and should not be procured. Centralized uniform testing of these items on a request basis is essential to procure quality equipment and to maintain state-of-the-art technology in pest control.

Progress: Evaluation of the Micro-Gen G-88 demonstrated that this new (145 pound) aerosol generator could meet MIL-A-52940B. This is the first aerosol generator in that weight class to meet the standards. Plans have been finalized to test a TIFA aerosol generator and a LECO hand-held aerosol generator in FY 86.

In-House Work Unit: Technical Feasibility Testing (TFT) of Vector Control Equipment, DA0A6296, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

CONTROLLED-RELEASE, ENVIRONMENTALLY DEGRADABLE, PESTICIDE FORMULATIONS

Objective: To identify and evaluate environmentally compatible, controlled-release pesticide formulations of military relevance for field use. These formulations will provide the military with a new series of effective pesticides for control of medically important arthropods.

Military Relevance: Controlled-release, environmentally degradable pesticide formulation systems are needed to replace the persistent, broad-spectrum pesticides, like dichloro-diphenyl-trichloro-ethane (DDT), that have been cancelled or suspended. The current formulations of new compounds are short-lived and have relatively short shelf life. These military shortcomings can be overcome through application of controlled-release technology. This should result in reduced pesticide usage.

Progress: Formulation evaluations of second-generation, microencapsulated Bacillus thuringiensis (serotype 14) were completed. Persistence was not increased substantially over first-generation formulations. Commercial formulations will be examined for use in Military Operations Urban Terrain (MOUT).

In-House Work Unit: Controlled-Release, Environmentally Degradable, Pesticide Formulations, DA0B6223, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

PESTICIDE DISPERSAL UNIT, MULTICAPABILITY, HELICOPTER SLUNG

Objective: To identify a suitable commerical helicopter slung, dispersal unit for applying both liquid and solid formulations of insecticides which would (a) dispense insecticides when slung beneath a helicopter, (b) require no modification of the aircraft, and (c) apply adequate swath widths and deposition rates for controlling arthropod disease vectors.

Military Relevance: Medical personnel engaged in field operations need the capacity for aerial dispersal of both liquid and solid pesticide formulations. The unit is needed to ensure rapid treatment of large areas inaccessible by ground equipment but too small for efficient use of larger aerial dispersal equipment. The current, internally mounted, dispersal unit is a health and safety hazard to the helicopter crew.

Progress: A multicapability unit, which is slung beneath a helicopter on the cargo hook, has been adapted for military use. The unit has been successfully tested in Panama 3Q84 and in the Philippines 4Q84. The unit was used in the first recorded control effort to suppress ticks by aerial application. The test was conducted at Fort A. P. Hill, VA, during 3Q85, with a greater than 50 percent reduction in the tick population.

In-House Work Unit: Pesticide Dispersal Unit, Multicapability, Helicopter Slung, DA305615, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

PESTICIDE DISPERSAL UNIT, PORTABLE, BACKPACK

Objective: To identify a commercially available, lightweight, backpack unit capable of dispersing solid or liquid pesticide formulations. This unit would be used in combat zones and in CONUS for controlling disease vectors and pest arthropods.

Military Relevance: The unit is needed to disperse both liquid and solid pesticide formulations during field operations where vehicular or aerial disperal equipment cannot be used or is not readily available.

Progress: The certificate of transition was received from the US Army Troop Support Command (TROSCOM) in December 1984.

In-House Work Unit: Pesticide Dispersal Unit, Portable, Backpack, DA0B6193, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

SPRAYER, POWERED, ULV, PORTABLE

Objective: To identify a commercially available, lightweight, portable unit capable of dispering ultra-low volume (ULV) pesticide formulations.

Military Relevance: Previous wartime experiences have demonstrated the devastating effects of outbreaks of arthropod-borne diseases on military operations. Many outbreaks start from a small localized area, too large for a field sanitation team to handle but too small for efficient treatment using vehicle-mounted equipment. A small, portable, ULV sprayer is the indicated equipment for local control of flies, mosquitoes, and other flying pests.

Progress: The certificate of transition was received from TROSCOM in December 1984.

In-House Work Unit: Sprayer, Powered, ULV, Portable, DA0G0677, US Army Medical Bioengineering Research and Development Laboratory (Nelson, J. H.).

TRAP, MOSQUITO, LIGHT, COLLAPSIBLE

Objective: To develop a collapsible mosquito light trap which is powered solely from AC sources. The trap may be used with 110 volt outlets or with portable gasoline generators for disease vector and pest mosquito surveys. This will replace the standard mosquito light trap (NSN 3740-00-607-0337) which is noncollapsible and approaching obsolescence.

Military Relevance: Light traps are the primary method of detecting and estimating mosquito populations to establish disease transmission thresholds.

Progress: A second prototype design has been fabricated. This prototype is undergoing field and laboratory testing to assure that it traps disease vectors in an effective manner. Testing will also determine durability and reliability.

In-House Work Unit: Trap, Mosquito, Light, Collapsible, DA0G0701, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

Contract: Testing of the USAMBRDL Collapsible Light Trap in Panama, DA307558, US Army Medical Department Activity, Panama (Lawson, M. A.); Boobar, L. R.

DEVELOPMENT OF AN AQUATIC THERMISTOR FLOWMETER WITH IBM PERSONAL COMPUTER (PC) INTERFACE FOR MONITORING FLOW RATES WITHIN LABORATORY LARVAL BLACK FLY COLONIES

Objective: To develop an aquatic thermistor flowmeter with IBM Personal Computer interface for use by this Laboratory in the maintenance of a larval black fly colony and to supply reliable flow rate data during controlled release pesticide studies. This program is directly related to the Laboratory's mission for research in military vector control.

Military Relevance: Currently, black flies seasonally restrict use of vast military training areas at some CONUS installations. In parts of Africa and Central and South America they are the primary vector of onchocerciasis or river blindness, a disease of military importance. Effective vector control strategies will permit increased military training at those installations and will reduce the potential threat of casualties due to onchocerciasis. Knowledge of the ecology of running water, particularly that which defines the life limiting flow rates of aquatic organisms, will influence the military's approach to control strategies.

Progress: Existing thermistor flowmeter designs were evaluated and modified. Two new designs have been developed and evaluated along with associated components (i.e., thermistors, operational amplifiers, etc.). An analog/digital data acquisition module has been selected to allow computer interface. The principal success of this project was the technical transfer of the first flowmeter design to the University of Alberta, Edmonton, Alberta, Canada. The design was presented at the American Mosquito Control Association meeting, and a paper will be published in the New Jersey Mosquito Control Association Proceedings. The University of Manitoba, Winnipeg, Manitoba, Canada, and the University of Quebec, Three-Rivers, Quebec, Canada, have been working on thermistor flowmeters without success for many years. Their interest in this project is keen, and communications on calibration techniques led to the construction of an inexpensive calibration device.

In-House Work Unit: Development of an Aquatic Thermistor Flowmeter with IBM PC Interface for Monitoring Flow Rates within Laboratory Larval Black Fly Colonies, DA306956, US Army Medical Bioengineering Research and Development Laboratory (Boobar, L. R.).

FATE OF BACILLUS THURINGIENSIS (SEROTYPE H-14) SPORES IN MOSQUITO LARVAE KILLED BY DELTA-ENDOTOXIN

Objective: To demonstrate that Bacillus thuringiensis var. israelensis replicates and synthesizes endotoxin de novo in association with mosquito larval cadavers.

Military Relevance: Bacillus thuringiensis (serotype H-14) represents the first major biological control larvicidal agent to be registered for commercial production and application. This material is now used in many Integrated Pest Management programs including some at military installations where pesticide use regulations require minimum negative impact to the environment.

Progress: A pasteurization system was devised for heat killing vegetative cells of B. thuringiensis var. israelensis without inactivating spores. This system was successfully used to enumerate spores isolated from mosquito larval cadavers. A filtration method was also used to isolate crystals of the endotoxin produced during sporulation occurring in association with cadavers. The principal success of this project is the confirmation of the hypothesis that B. thuringiensis var. israelensis undergoes complete cycling in association with the larval cadavers of Aedes aegypti. The results of the study also demonstrate that the observed toxicity of cadavers was the result of newly synthesized toxin and not the accumulation of toxin contained in the initial infective dose. The results confirm that the toxin produced de novo was crystalline endotoxin.

In-House Work Unit: Fate of Bacillus thuringiensis (Serotype H-14) in Mosquito Larvae Killed by Delta-Endotoxin, DA303166, US Army Medical Bioengineering Research and Development Laboratory (Vorgetts, L. J.).

HEALTH EFFECTS RESEARCH DIVISION

The Health Effects Research Division (HERD) consists of a team of life scientists, chemists and engineers responsible for the planning and conduct of basic, occupational and environmental research programs. These programs are the research support elements for the Army preventive medicine and health hazard assessment missions. The research programs resulted in the development of complete biomedical or environmental data bases on unique military toxicants to provide the basis for criteria, standards and health or environmental decision making to promote the health of soldiers, DA civilians and the public, to promote environmental protection and to enhance mission performance. HERD staff members provide consultative services in a variety of science and engineering disciplines to OTSG, DA and other DOD elements.

The Research Management Branch develops and manages extramural research programs in occupational health and environmental quality responsive to the needs and requests of the OTSG and the user communities of DA and DOD. The areas of primary emphasis are the health effects and risk assessments in (a) Chemical and Conventional Weapons, (b) Field Sanitation and Water, (c) Fuels and Lubricants, (d) Installation Restoration, and (e) Smoke and Obscurants. Basic research is performed to implement and facilitate analytical methodologies where time and costs need to be reduced and where alternatives to animal testing may prove useful. Research results may be used to help establish health effects exposure limits and standards; to reduce health and environmental risks in military training and operations, in demilitarization operations, in munitions manufacture, in waste disposal, and in site-specific, land use-specific considerations. In addition, consultative services in these areas as well as in chemistry, engineering, microbiology, and toxicology are provided as required to OTSG, DA, DOD, and to support Army Defense in Litigation Actions.

The Laboratory Research Branch conducts in-house research in analytical chemistry, environmental engineering, aquatic toxicology, and environmental microbiology in support of Defense Research Sciences, Systems Health Hazards Prevention Technology, and Environmental Quality Technology. Specialized areas of research include: development of analytical methods; chemical characterization of waste streams; synthesis of Army-unique chemicals; environmental fate studies; pilot-scale treatability studies; development of aquatic toxicity testing methods; standard acute and chronic aquatic toxicity testing; microbial fate and metabolic product studies; and microbial characterization of waters.

BASIC RESEARCH PROGRAM

The efforts in the basic research program continue in the development of models and bioassays which are predictive of adverse biologic effects on humans, ecosystems and the environment. These predictive models will allow

hazard assessments to be done in a faster, less costly manner and enable more definitive predictions of potential hazards from Army actions. Emphasis is on the development of environmental effects and fate models, shorter term substitutes for mammalian toxicity models, alternate species for assessing oncogenic potential, standardization of suitable systems for estimating hazards, and extrapolation models for deriving human hazards from animal data bases. Research was as follows:

Basic Research

Objective: Develop predictive models of adverse effects on humans and the environment from exposure to contaminants and determine toxic hazards created by military-unique chemicals and exposures.

Military Relevance: These models and protocols will provide more rapid, less expensive and more sensitive bases for hazard assessment studies of Army pollutants for contaminant clean-up, pollution control and protection of soldiers.

Progress: Studies on environmental effects models show that plants uptake polar organics compounds and these compounds are rapidly metabolized but the distribution varies among different plant parts. The aquatic microcosm model has been assayed in a number of laboratories and was found to be reproducible. In development of a fish neoplasia model, certain species were found to be more sensitive to the oncogenic effects of water contaminants and tumors were present after exposure to ambient water pollutant levels. A computerized system for predicting potential hazards of environmental contaminants has shown the feasibility of using literature values for chemical properties and animal toxicity to do hazard assessments. Development and validation of reproductive toxicity models and methods for extrapolating lung deposition from animal data to humans are continuing. A hybrid mouse tumorigenicity model is under development and studies on DNA adduct formation show differential production and persistence of these adducts among tissues and mouse strains.

Contracts: Plant Uptake of TNT, DA307124, US Cold Regions Research and Engineering Laboratory (Palazzo, A.J.); Gardner, H.S.

Biochemical, Pharmacological and Tumorigenic Effects of Drinking Water Carcinogens on Fish, DA301798, National Cancer Institute, (Cameron, T.P.); Kelly, J.A.

Collaborative Research Program: Interlaboratory Testing of Aquatic Microcosm Protocol, DA302965, Food and Drug Administration, (Hoffman, B.L.); van der Schalie, W.H.

Histological, Histochemical, and Ultrastructural Characterization of Lesions in Fishes Exposed to Known Carcinogens with Emphasis on Neoplastic Development, DA302452, US Environmental Protection Agency, Environmental Research Laboratory, (Couch, J.A.); Kelly, J.A.

Extrapolation of Inhaled Particulate Toxicity Data from Experimental Animals to Humans, DA305393, US Environmental Protection Agency, Health Effects Research Laboratory, (Hatch, G.E.); Henry, M.C.

Computerization of a Preliminary Pollutant Limit Value Concept, DA304825, US Army Construction Engineering Research Laboratory, (Messenger, R.M.); Henry, M.C.

The Development of a Mathematical Model to Describe the Fate of 2,4,6-Trinitrotoluene (TNT) in a Vascular Aquatic Plant System, DA301451, Tulane University, (Englande, A.J.); Gardner, H.S.

Estimation of Melting Point, DA306024, University of Arizona, (Yalkowsky, T.H.); Rosenblatt, D.H.

Reproductive Evaluation of Potential Toxicants, DA305366, US Environmental Protection Agency, Health Effects Research Laboratory, (Lasky, J.W.); Bausum, H.T.

Development of a Mouse Lung-Liver Model for the Testing of Military-Relevant Compounds for Carcinogenic Activity, DA306631, Medical College of Ohio, (Stoner, G.D.); Finch, R.A.

AQUATIC TOXICOLOGY

Objective: To provide aquatic toxicity data for Army-relevant materials and to develop new methods necessary for assessing the hazards of these materials to aquatic organisms.

Military Relevance: Army facilities generate a variety of waste effluents that are released into aquatic systems and are regulated under both state and federal laws. Aquatic toxicological data are frequently required to allow establishment of appropriate effluent discharge standards and for environmental hazard assessment.

Progress: Reports summarizing aquatic toxicity data relevant to the production of nitroguanidine at Sunflower Army Ammunition Plant were generated. Data on the effects of 1,3,5-trinitrobenzene (TNB) on the ventilatory and movement patterns of fish were analyzed. A report summarizing previous research on the toxic interactions of two nitroaromatic compounds was completed. No evidence of tumors was found in fathead minnows held in clean water for 1 year after a 35-day exposure to 2,4-dinitrotoluene (2,4-DNT), 2,6-DNT, and a mixture of the two isomers. This study is being repeated with a more sensitive species and has been expanded to test the ability of 2,4- and 2,6-DNT to promote tumor development. The use of increased temperature to enhance tumor production and lessen the time to tumor production in a carcinogen screening test is being explored. Fish tested at 35°C did not show an increased incidence of tumors over those tested at 25°C, but survival at 35°C was poor. A second test was initiated with fish tested at 25° and 30°C. A total of 10 tests for evaluating the relative effects of constant and pulsed exposures of TNB on daphnids has been completed. Pulsed exposures of TNB were generally less toxic than continuous exposures.

In-House Work Units: Basic Research in Aquatic Toxicology, DA0G8688, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W.H.).

Aquatic Toxicology Test Method Development, DA301054, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W.H.).

Screening of Military Relevant Chemicals for Toxicity to Aquatic Organisms, DA0B6188, US Army Medical Bioengineering Research and Development Laboratory, (van der Schalie, W.H.).

Contract: Determination of the Toxicity to Aquatic Organisms of HMX and Related Wastewater Constituents, DA0G2232, EG&G Bionomics, (Petrocelli, S.R.); van der Schalie, W.H.

OCCUPATIONAL HEALTH RESEARCH PROGRAM

The occupational health research program has seven areas of research emphasis: conventional weapons, chemical weapons, fuels and lubricants, smoke and obscurants, field sanitation and water, mass spectrometry, and water chemistry. An overriding concern for all of these areas has been the inability to clearly ascertain the Army users' needs for health research. Several administrative mechanisms have been defined for some of the research areas, but an additional effort, especially by the chain of command, is needed to ensure that occupational health research programs meet the needs of the soldier. Emphasis has been placed on the development of field drinking water standards and technology to detect water toxicity. Future emphasis on water toxicants will include additional data on toxicity, detection, and disinfection requirements. The smoke and obscurants and chemical weapons research areas made significant progress toward establishing toxicological data bases. The bulk of these projects will be completed in the next couple of years. Attention is being directed in all subject areas to programs which define the actual exposure environment of the soldier and the medical demographics of individuals exposed. New concepts in defining performance degradation as a biological end point, as opposed to the more classical acute and chronic end points, are being actively explored.

CONVENTIONAL WEAPONS

Objective: To assess the acute, chronic and performance degradation potential of chemical substances associated with the Materiel Acquisition Cycle.

Military Relevance: Elimination of hazards due to chemical exposure in the military workplace will reduce death and nonbattle injury.

Progress: Research efforts focused on evaluations of weapons combustion product hazards and ammunition product hazards in production facilities. Techniques for evaluating carbon monoxide exposure constituted the major

research effort in the combustion products program, with the bulk of additional efforts focused on chemical analysis of combustion products. A draft report on steady-state exposure to low concentrations of CO (100 ppm) at military-relevant workload was completed. Within the experimental design constraints, predictions of COH's were acceptable for all algorithms tested. The draft report is under review. Select aspects of the completed work are being used to design a new protocol involving transient exposures. In studies of neurobehavioral effects of CO, pilot studies for high level transient CO protocol have begun. To date four subjects have been tested with CO. A Technical Report on Putz Replication has been published. A study on Speech Perception in Noise (SPIN) has been completed for publication in a peer-review journal. Planning meetings for upcoming field studies have been initiated and are continuing. The study by CIIT has entered its fourth year. In January 1984, the principal investigator reached a preliminary conclusion that the overall death rate was significantly higher than would be expected for the US white male populations. The deaths were due principally to diseases of the circulatory system (heart disease, blood vessel disease, etc.). Significantly deaths due to cancer were not noted on death certificates as an underlying or contributing cause of death. A minor, but significant amount of data analysis remains to be performed. These include evaluating the role that nitrotoluenes other than 2,4- or 2,6-DNT at Joliet AAP may have had in enhancing cardiovascular disease. Also, the selective service classification numbers for members of the Radford cohort will be examined to determine the extent and distribution of persons considered medically unfit for military service. CIIT is preparing the final report and preparing for a technology transfer meeting. Benzothiazole was tested and shown to be nonmutagenic using the Ames Salmonella assay. The evaporator sludge has been fractionated and the fractions submitted to the Ames assay. The results were negative probably due to sample dilution. Using the sister chromatid exchange assay the sludge samples were found to have mutagenic activity. Ammunition products research has included assessing the hazards of new processes for RDX/HMX and diethyleneglycoldinitrate-based propellants. Sample shipment received January-February 1985. Difficulties with creating test solutions resolved June 1985. The mouse lymphoma assay was initiated August 1985. LAIR received TMETN, TEGDN, DEGDN, DEGDN-JA2, and DEGDN-DIGL-RP and started analysis of chemical composition of these propellants. Protocols for the toxicological evaluations of these chemicals were approved. Acute toxicological evaluation of TMETN and TEGDN is completed and draft reports on some tests are in review and others are in preparation. TMETN and TEGDN were found to be non-irritating to eyes (0.1 g/eye) and nonirritating to skin (0.5 g/site) of rabbits, non-sensitizing to guinea pigs and oral LD50 are greater than 500 mg/kg to rats and mice. They were also found to be negative in Ames mutagenicity tests. Experiments with other chemicals are in progress. A literature review on the chemical analysis of weapons combustion products has been completed and a draft report is being prepared. Literature reviews to support other phases of the research have been initiated.

Contracts: Human Health Studies of Carbon Monoxide (CO) Under Conditions of Military Weapon System Crewman Exposure, DAOG7486, US Environmental Protection Agency, Health Effects Research Laboratory, (Petrovick, M.L.); Parmer, D.

Neurobehavioral Effects of Carbon Monoxide (CO) Exposure in Humans, DAOG7494, US Environmental Protection Agency, Health Effects Research Laboratory, (Benignus, V.A.); Kelly, J.A.

Mortality of Munitions Workers Exposed to Dinitrotoluene, DAOG3440, Chemical Industry Institute of Toxicology, (Levine, R.J.); Parmer, D.L.

Characterization of Combustion Products of Military Propellants, DA OG2223, IIT Research Institute, (Snelson, A.); Parmer, D.L. Awaiting printing of final report.

Evaluation of DEGDN (Diethyleneglycoldinitrate) and Two DEGDN Containing Compounds, DA305429, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Parmer, D.L.

Toxicity Testing of DEGDN and DEGDN-Based Propellants, FAD-110, Letterman Army Institute of Research, (Korte, D.W.); Reddy, G.

Health Effects Research on Dimethylsulfoxide (DMSO) Munition Recrystallization Process Solvent, Phase II, DA305606, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J.C.

Problem Definition Study for Evaluating the Chemical and Toxicological Properties of the Combustion Products of Rifle and Gun Systems, DA307122, Department of Energy, Oak Ridge National Laboratory (Ross, R.H.); Parmer, D.L.

CHEMICAL WEAPONS SYSTEMS

Objective: The objective of the projects grouped under this area are to conduct toxicological research to develop a complete health effects data base on selected chemical warfare agents.

Military Relevance: This area research was established in 1982 and is being developed in response to specific health hazard issues, in particular, the potential for teratogenic initiation and the health hazards for occupational exposures of military personnel, Army civilians, and contractor workers associated with a potential exposure to chemical agents.

Progress: Toxicity studies on Agent VX, including teratogenicity, and teratology studies on Agents GB and GD initiated in 1982 have been continued through 1983. The following studies on VX have been completed and draft final reports have been prepared: Ames Salmonella assay, Saccharomyces assay, teratology in rats, mouse lymphoma study, and the

acute delayed neuropathy study in chickens. The following studies have been completed and reports are in preparation: teratology in rabbits, three-generation reproduction study in rats, and a 90-day oral study in rats. The two final studies in this contract, the dominant lethal study in rats and a subchronic delayed neuropathy study in chickens, are in progress. Toxicity studies on Agents GB and GD were initiated in September 1984, also at the Laboratory for Energy-Related Health Research. All the Phase I studies (Ames assay, mouse lymphoma assay, in vitro sister-chromatid exchange assay, and unscheduled DNA synthesis in rat hepatocytes are on-line and positive controls are being evaluated. Teratology studies on Agent GB, Type I and Type II in the rat and rabbit have been completed and a preliminary progress report has been received. Studies with GD in the rabbit are in progress. This work, and the GD teratology studies, are being carried out at the National Center for Toxicological Research, Division of Teratogenesis Research, Jefferson, AR, and are due to be completed by June 1985 (GB) and September 1985 (GD). Phase II toxicity studies on Agents GB and GD were initiated on Agents GB and GD at the National Center for Toxicological Research in July 1985, and are due to be completed by August 1988. Studies include the following: a 90-day oral in rats, a dominant lethal in rats, a two-generation in rats and a delayed neuropathy in chickens. Teratology studies on Lewisite and Sulfur Mustard agents which were initiated in May 1983 have been continued. A draft final report on the results of the sulfur mustard studies in both rats and rabbits has been prepared. This work which is being carried out in the Battelle Pacific Northwest Laboratories, Richland, WA, is due for completion by October 1985. Further studies on the toxicology of these agents were initiated in September 1984 at the same laboratories. Studies include the following: Ames assay, CHO/HGPRT forward mutation assay, in vitro sister chromatid exchange, and chromosome aberration assay, unscheduled DNA synthesis in rats, 90-day subchronic study, modified dominant lethal study, and a two-generation reproductive toxicity study in rats.

Contracts: Toxicity Studies on Agent VX, DA300087, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J.C.

Teratology Studies on Agent GB, DA300105, Food and Drug Administration, National Center for Toxicological Research, (LaBorde, J.B.), Dacre, J.C.

Teratology Studies on Agent GD, DA302231, Food and Drug Administration, (LaBorde, J.B.); Dacre, J.C.

Toxicity Studies on Agents GB and GD, DA305392, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J.C.

Teratology Studies on Lewisite and Sulfur Mustard Agents, DA302726, Department of Energy, Battelle Pacific Northwest Laboratories, (Hackett, P.L.); Finch, R.A.

Toxicity Studies on Lewisite and Sulfur Mustard Agents, DA305394, Department of Energy, Battelle Pacific Northwest Laboratories, (Sasser, L); Finch, R.A.

FUELS AND LUBRICANTS

Objective: Assess the toxic effects of Army fuels and lubricants on soldiers and Department of the Army civilians and provide recommendations regarding fuel/lubricant sources, chemical constituents or use to minimize any deleterious health effects.

Military Relevance: The Army's use of fuels and lubricants of many varieties is widespread in both garrison and field environments. Toxic effects, to include performance effects, of the military use of these materials could have wide ranging impact on mission performance.

Progress: Research has been focused on characterizing the various chemical constituents of both parent diesel fuels and their combustion products. Work done thus far has shown a possible contribution to diesel exhaust by crankcase oil thus possibly modifying toxicity. Planned research will seek to compare diesel fuels from a variety of sources to determine the variability of their composition and the effects of that variablity on combustion products. Using this information and an assessment of work done by other Federal agencies, toxicology research will be focused on the materials of relevance to Army personnel.

Contracts: Army Synthetic and Alternative Fuels Health Hazard Characterization, DA0H0036, Department of Energy, Oak Ridge National Laboratory, (Guerin, M.R.); Reddy, G.

Field Sampling and Analysis of Shale Oil Derived Airborne Diesel Exhausts, 84PP4867, Department of Energy, Oak Ridge National Laboratory, (Guerin, M.R.); Gardner, H.S.

SMOKE AND OBSCURANTS RESEARCH

Objective: Develop a health hazard data base on smoke and obscurants to enable development of health protection guidelines and exposure criteria for occupational and field exposures which meet the users' needs.

Military Relevance: The application of preventive medicine research to the operational community; reduce human performance degradation in combat, field training and military industrial plants.

Progress: Hazard assessment studies on two inventory items, two product improved systems and one developmental item continued and are nearing completion. Research studies on one inventory and two product improved items were initiated. Phosphorus-based fill materials in the XM819 gave

combustion products similar to those released from the M825 and L8A3. The combustion products from the L8A3 produced fibrotic changes at the lowest concentration tested. Additional studies are in progress to determine a no effect level. The dyes in the red and violet M18 grenades do not demonstrate significant mutagenic potential.

Contracts: Inhalation Toxicology of Fog Oil Obscurant, DAOG7492, US Environmental Protection Agency, Health Effects Research Laboratory, (Grose, E.); Finch, R.A.

Chemical Characterization and Toxicologic Evaluation of Airborne Mixtures, DAOG5136, Department of Energy, Oak Ridge National Laboratory, (Guerin, M.R.); Eaton, J.C.

Studies on the Inhalation Toxicity of Dyes Present in Colored Smoke Munitions, 83PP3807, Department of Energy, Inhalation Toxicology Research Laboratory, Lovelace Biomedical and Environmental Research Institute, Inc., (Henderson, R.F.); Kelly, J.A.

Chemical and Physical Characterization of XM819 Red Phosphorus Sodium Nitrate Obscurant Aerosol, 84PP4827, Department of Energy, Oak Ridge National Laboratory, (Guerin, M.R.); Eaton, J.D.

Short-Term In Vitro Screening Studies Related to the Inhalation Toxicology of Potentially Toxic Aerosols, 84PP4850, US Environmental Protection Agency, Health Effects Research Laboratory, (Graham, J.); Finch, R.A.

Genotoxicity of Dyes Present in Colored Smoke Munitions, 85PP5801, Department of Energy, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Inc., (Henderson, R.); Kelly, J.A.

Comparative Inhalation Toxicology of Selected Materials, 85PP5805, Department of Energy, Inhalation Toxicology Research Institute, Lovelace Biomedical and Environmental Research Institute, Inc., (Snipes, M.B.); Henry, M.C.

Toxicity of DEGDN, Synthetic HC Smoke Combustion Products, Solvent Yellow 33 and Solvent Green 3 to Freshwater Aquatic Organisms, DA307134, Applied Physics Laboratory, The John Hopkins University, (Burton, D.J.); Kelly, J.A.

Research and Development on Inhalation Toxicologic Evaluation of Red Phosphorus/Butyl Rubber Combustion Products, DAOH0386, IIT Research Institute, (Aranyi, C.); Finch, R.A.

Dermal, Eye and Oral Toxicologic Evaluations, DA300090, American Biogenics Corporation, (Muni, I.A.); Reddy, G.

FIELD SANITATION AND WATER

Objectives: Conduct preventive medicine research in field water supply and sanitation to enhance the readiness and operational capability of the field soldier in combat and training.

Military Relevance: Field preventive medicine personnel need increased knowledge, health standards and appropriate analytical capabilities, and improved problem solving ability in order to prevent exposure of troops to high risks of disease, illness or injury from consumption or contact with unsafe field water supplies, or from improper hygiene and sanitation procedures.

Progress: A screening and evaluation of waterborne chemicals, microorganisms, and opportunity poisons was performed to ascertain the need for additional water quality standards and risk assessment indices; improved standards were sought for chemical threat agents. Breadboard field biotoxicity monitoring equipment was designed and built and advanced feasibility tests were initiated. New N-chloroamine disinfectant compounds were synthesized and evaluated; toxicity testing of the best candidate compounds was started. Procedures for evaluation of VX detoxification components were established.

Contracts: Data Base Assessment of Environmental and Toxicological Factors in Water to Upgrade and Modernize Content of TB Med 577, DA300881, Department of Energy, Lawrence Livemore National Laboratory, (Anspaugh, L.R.); Schaub, S.A.

Evaluation of Field Water Data Base Assessment Study Deliverables, DA304816, Department of Energy, Oak Ridge National Laboratory, (Ross, R.H.); Schaub, S.A.

Chemistry and Toxicology of Water Treated with Hypochlorite to Detoxify Chemical Agent VX, DA305445, Department of Energy, Battelle Pacific Northwest Laboratories, (Kalkwarf, D.R.); Rosenblatt, D.H.

New Disinfection Agents for Water, DA300021, Auburn University, (Worley, S.D.); Eaton, J.C.

Rapid Bioassay Monitoring System for Water Quality, Phase II, Tasks 2-12, DA303278, Wyatt Technology Company, (Wyatt, P.J.); Schaub, S.A.

Toxicity Studies of Water Disinfection Compound I, (No DA #) Letterman Army Institute of Research, (Korte, D.W., Jr.); Eaton, J.C.

MASS SPECTROMETRY

Objective: To provide state of the art in-house research capability in mass spectrometry to solve Army health and environmental problems.

Military Relevance: Areas of military relevance include occupational health, field water quality, wastewater discharge from military installations, and problems related to the presence of Army-derived chemicals and other toxic substances in the environment.

Progress: Chemical characterization of trace organics in water samples from testing of a field water treatment system designed to reuse or recycle shower water has been completed. Results showed that no new trace organics were formed during the treatment process even after chlorination, and the total trace organic content appeared to decrease with increasing number of recycles. Results of the first of a series of chemical degradation studies of trichothecenes by hypochlorite have been submitted for peer review publication; the work is to be continued with other trichothecenes.

In-House Work Unit: Alkaline Hypochlorite Treatment of Trichothecenes: A Product Study, DA 305524, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, E.P.).

Contract: Health Effects Research on Dimethylsulfoxide Munitions Recrystallization Process Solvent, Phase II, DA305606, Department of Energy, Laboratory for Energy-Related Health Research, (Goldman, M.); Dacre, J. C.

WATER CHEMISTRY

Objective: To maintain state of the art and personnel experienced in the water chemistry laboratory to conduct water and wastewater analyses and to develop analytical methods.

Military Relevance: Analyses are required to support health hazard assessment of Army munition plant wastewaters and other in-house research; development of analytical methods are required to study Army-unique problems in the areas of health, environment, and field water supplies.

Progress: Over the past year a prototype real-time atmospheric HCl monitor has been under development. The nerve agents GD and GB have been successfully detected from natural waters at or below the 5)g/L using the enzyme test ticket and solid phase extraction techniques. Plans have been made and facilities have been acquired to conduct combustion product studies on small calibre weapons in-house.

In-House Work Units: Adsorbents for the Recovery, Enrichment, and Transport of Chemical Warfare Agents Found in Water, DA302678, US Army Medical Bioengineering Research and Development Laboratory, (Hoke, S.H.).

ENVIRONMENTAL QUALITY RESEARCH PROGRAM

The objective of the Environmental Quality Research Program is to conduct comprehensive basic and applied research to develop ecological and human health effects and hazards data bases and treatment technologies for militarily relevant pollutants and hazardous materials. This involves environmental chemistry, soil science, microbiology, botany, toxicology, zoology, and engineering. The program is directed towards assessing the potential hazard of water and airborne discharges from Army industrial and field operations in the topical areas of smokes and obscurants, conventional munitions production and demilitarization, solid waste disposal, and installation restoration. The ultimate output of the research program is Environmental Quality Criteria Documents, USEPA issued Medical Advisories and innovative waste treatment technologies. This program is a Thrust Area of the Army's Environmental Quality Technology Program serving to fulfill, under Chapter 2 of AR 200-1, part of the Army Surgeon General's environmental quality protection and Installation Restoration mission requirements. The basis for this program can be found under E.O. 12088 which requires Army and other Federal Agency compliance with the National Environmental Policy Act, the Clean Air Act, the Clean Water Act, the Toxic Substances Control Act, and the Resource Conservation and Recovery Act. To ensure that the research conducted in this program will be acceptable to Federal regulatory agencies, continuous coordination is maintained with the US Environmental Protection Agency (EPA). Routine coordination is also maintained with other DA and DOD activities, as well as other Federal agencies, so that government resources for environmental and health effects can be effectively utilized. Research was as follows:

ENVIRONMENTAL QUALITY TECHNOLOGY

Objective: The objective of the research area is to provide environmental and health effects data bases for Army-unique materials.

Military Relevance: The data bases developed under this research area are used to maintain readiness by protecting training areas from chemical damage and by providing guidelines for designing economical treatment processes to reduce the impact from discharges from Army industrial operations.

Progress: Research required to provide the data base to develop Environmental Quality Criteria for military-unique air, water, and soil pollutants continued during FY85. The final report on the environmental fate of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazine (HMX) was

completed. Studies were completed defining the fate of white phosphorus/felt (WP/F) and red phosphorus/butyl rubber (RP/BR); a draft final report was delivered. The final volume of the report was delivered covering the study on the aquatic toxicity of 2,4,6-trinitrotoluene (TNT) and related munitions constituents. A final report on the chronic toxicity of LAP (load, assemble, and pack) wastewater continues to await finalization by the contractor. The chronic mammalian bioassay of TNT was completed; the final reports are under review. A study designed to evaluate the ecological effects of smokes in a microcosm was completed; the draft final report is being reviewed. A data base assessment of munitions production solid wastes was completed this year.

A study of the neurotoxicity of hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX) was completed and a draft final report was delivered. A study to develop methods to estimate the physical/chemical properties of inorganics continued. Data base assessments of current and future smokes, demil technologies, and potential hazardous Army solid wastes continued. Aquatic bioassays of WP/F, RP/BR and Fog Oil smokes along with a study to evaluate the fate and effects of IR screening smokes neared completion. Acute mammalian toxicological evaluations of the propellants nitroguanidine (NQ), ball powder, diethyleneglycol dinitrate and other nitrated glycols continued in FY85. Studies to refine, develop or evaluate smoke dispersion/deposition models, along with efforts to define the effects of smokes on plants and soils in a dynamic wind tunnel were continued. Methods to monitor effects of smoke on vegetation during field exercises will be evaluated beginning in FY85. A study to determine the fate of military organics in landfills neared completion. Compilation and review of data for RDX, nitroglycerine (TNG) and nitrocellulose (NC) continued for the purpose of developing final Environmental Quality Criteria.

New initiatives included a joint study with EPA to develop standardized software to evaluate mutagenicity data and a study to relate chemical structure to hepatotoxicity. Under an Interagency Agreement with the EPA, efforts were initiated to develop and promulgate Medical Advisories for munition compounds.

Contracts: Chemical Characterization and Toxicologic Evaluation of Airborne Mixtures, DAOG5136, Department of Energy, Oak Ridge National Laboratory, (Guerin, M.R.); Eaton, J.C.

Neurotoxicology of Cyclotrimethylenetrinitramine (RDX), DA300033, US Environmental Protection Agency, Health Effects Research Laboratory, (MacPhail, R.); Reddy, G.

Data Base Assessment of Health and Environmental Effects of Munition Production Waste Products, DA300877, Department of Energy, Oak Ridge National Laboratory, (Ross, R. H.); Rosencrance, A.B.

Conventional Weapons Demilitarization: A Health and Environmental Effects Data Base Assessment, DA302760, Department of Energy, Lawrence Livermore National Laboratory, (Layton, D.); Rosenblatt, D.H.

Smokes and Obscurants: A Health and Environmental Effects Data Base Assessment, DA302759, Department of Energy, Lawrence Livermore National Laboratory, (Shinn, J.H.); Rosenblatt, D.H.

Acute Toxicity of Smoke Screen Materials to Aquatic Organisms, DA303024, Department of Energy, Battelle Pacific Northwest Laboratories, (Poston, T.M.); van der Schalie, W.H.

Environmental Effect Studies on EA5763, DA306599, US Army Armament Munitions and Chemical Command, (Wentsel, R.S.); Gardner, H.S.

Evaluate and Characterize Mechanisms Controlling Transport, Fate and Effects of Army Smokes in the Aerosol Wind Tunnel, DA304087, Department of Energy, Battelle Pacific Northwest Laboratories, (van Voris, P.); Barkley, J.J.

Field Measurement and Model Evaluation Program for Assessment of the Environmental Effects of Military Smokes, DA304000, Department of Energy, Argonne National Laboratory, (Policastro, A.J.); Parmer, D.L.

Water Quality Criteria for Six Munitions Compounds, DA304532, Department of Energy, Oak Ridge National Laboratory, (Ross, R.H.); Parmer, D.L.

Continuation of Field Ecological Assessment Procedures to Evaluate the Environmental Effects of Using Large Area Training Smokes, DA306104, US Army Construction Engineering Research Laboratory, (Novak, E.M.); Parmer, D.L.

Determination of the Chronic Mammalian Toxicological Effects of TNT, DAOG0666, IIT Research Institute, (Lish, P.M.); Barkley, J.J.

Determination of the Toxicity to Aquatic Organisms of HMX and Related Wastewater Constituents, DAOG2232, EG&G Bionomics, (Petrocelli, S.R.); van der Schalie, W.H.

Environmental Fate Studies of White Phosphorus/Felt and the Red Phosphorus/Butyl Rubber Military Screening Smokes, DA300100, SRI International, (Spanggord, R.J.); Barkley, J.J.

Terrestrial Microcosm Evaluation of Two Army Smoke-Producing Compounds, DA303077, Battelle Memorial Institute, (Duke, K.M.); Bratt, G.M.

A Health and Environmental Effects Data Base Assessment of US Army Waste Material, DA303914, Carltech Associates, Inc., (Uhrmacher, J.C.); Small, M.J.

Environmental Fate of Nitroguanidine, Diethyleneglycol Dinitrate, and Hexachloroethane Smoke, DA305052, SRI International, (Spanggord, R.J.); Kelly, J.A.

Mammalian Toxicity of New Propellants, FAD-AB, Letterman Army Institute of Research, (Korte, D.W.), Barkley, J.J.

ENVIRONMENTAL MICROBIOLOGY

Objective: The objective of this research is to detect and define the environmental longevity of pollutants, chemical substances and agents, and infectious agents which result from or are a threat to US Army operations.

Military Relevance: The US Army as a manufacturer and user of the propellant nitroguanidine is responsible to assess the environmental fate of chemical pollutants resulting from the manufacturing process. As potential chemical agents, simple assay systems are required for T_2 toxin and other trichothecene mycotoxins. Simple toxicity screening systems are needed for the evaluation of chemical substances resulting from the manufacture of military chemicals.

Progress: Results have indicated that although the propellant precursor, guanidine is biodegradable by microorganisms from numerous sites both as a carbon source and as a nitrogen source, the rate of its clearance from surface waters by microorganisms will be slow. Short-term incubation indicates that it is degraded 20 times slower than urea, and long-term incubation studies indicate that the development of biodegrading populations is concentration dependent. As a nitrogen source, most of guanidine's carbon is converted to carbon dioxide, the remainder being incorporated into biomolecules via heterotrophic carbon dioxide fixation. An assay for T_2 toxin using the yeast Cryptococcus luteolus was evaluated as a rapid screening device for toxic compounds of EPA and Army interest. Lowest observed effect levels are being compared to other toxicty screening methods.

In-House Work Units: Microbial Interactions with Guanidine, DA305995, US Army Medical Bioengineering Research and Development Laboratory, (Mitchell, W.R.).

ENVIRONMENTAL ENGINEERING

Objective: Research has been primarily directed toward development of treatment methods for wastewaters containing Army-unique chemicals of known or potential toxic hazard.

Military Relevance: This work relates to evaluation of public health and environmental health hazards associated with operation of Army industrial facilities.

Progress: During FY84, four projects were initiated addressing wastewater treatment at Holston Army Ammunition Plant: (1) rotating biological contactor treatment of raw wastewater, (2) semicontinuous activated sludge treatment of raw wastewater, (3) treatment of selected waste streams by ultraviolet radiation for removal of nitramines, and (4) evaluation of wastewater treatment processes presently in use at Holston AAP. Studies on products of nitroguanidine treatment continued.

In-House Work Units: Nitroguanidine Wastewater Pollution Control Technology Development, DA301042, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, W.D.).

Treatment of Munition Production Wastes, DA301069, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, W.D.).

Removal of Chemical Warfare Agents from Field Water Supplies by Reverse Osmosis: Development of Test Protocol and Efficacy Testing, DA303912, US Army Medical Bioengineering Research and Development Laboratory, (Burrows, W.D.).

Contracts: Prototype Testing of a Semicontinuous Activated Sludge Treatment System, DA308395, (Bell, B.A.), Burrows, W.D.).

ANALYTICAL CHEMISTRY

Objective: To develop analytical techniques for qualitative and quantitative determination of pollutants in water and biological samples, and to carry out research and development on the health hazards of the disposal of chemical and other wastes of military relevance.

Military Relevance: The Army needs a quick and easy methodology for estimation of pollutants in the field, and at military installations, and to investigate suitable methods for removal and disposal of wastes.

Progress: During FY85, research efforts were made in establishing availability and routes of syntheses of the hydrolysis products of CW agents GA, GB, GD, VX, and HD for the use of Army researchers and DOD agencies. The routes of synthesis have been selected or developed for isopropylmethyl, ethylmethyl, pinacolylmethyl, and methyl phosphonic acids, primary and secondary hydrolysis products of GA, GB, GD, and VX. The qualitative GC/MS and quantitative HPLC analyses of PAH components identified, were carried out on the three authentic deactivation ash samples from USAEHA. The bioaccumulative data on identified PAH and PANH

was also completed. Future work will concern the incineration with natural gas and open air detonation. The experimentally developed lithium thionyl chloride batteries by ERADCOM were tested for determination of health hazard in landfill disposal according to 40 CFR 261, and the final report is under preparation. The specific adsorbents for TNT, RDX, and HMX in wastewater from their manufacture were prepared and tested from silica gels and crosslinked polyacrylates; and further work based on ionic polymerization and silica gel modification in the presence of high concentration of these adsorbates is planned. The Army-unique chemical compounds, N,N'-bis(2,4,6-trichlorophenyl)u.ea (TCPU), diethylnitrosamine (DEN) and nitrosoguanidine were synthesized in quantity for toxicological and environmental fate study, after carefully developing their synthetic procedures.

In-House Work Units: Pollutant Adsorbent Systems, DA305522, US Army Medical Bioengineering Research and Development Laboratory, (Kulkarni, R.K.).

Analytical Reference Standards of Hydrolysis Products of Chemical Warfare Agents. The Syntheses for Testing and Evaluation, DA302680, US Army Medical Bioengineering Research and Development Laboratory, (Rosencrance, A.B.).

Contract: Data base Assessment of Health and Environmental Effects of Munition Production Wastes Products, DA300877, Department of Energy, Oak Ridge National Laboratory, (Ross, R.H.); Rosencrance, A.B.

INSTALLATION RESTORATION

Objective: To provide (1) new or revised methods for deriving maximum allowable levels of military-relevant chemical contaminants in soil or water, based on the physicochemical and toxicological properties of the contaminants, and on site-specific, land use-specific considerations; and (2) guidance and consultation to other military agencies on appropriate residual contaminant levels.

Military Relevance: As a particularly active member of the chemical manufacturing and user community, the Army is responsible for managing or excessing large tracts of land containing contaminated soil or water. This land must be so restored as to pose no significant risk to human health or to the environment.

Progress: In support of the US Army Toxic and Hazardous Materials Agency (USATHAMA) and the Department of Justice, a data base was assembled on over fifty compounds or ions associated with contamination at Rocky Mountain Arsenal. Appropriate criteria are being developed for analytical levels of these entities in soil and water, to make sure that the analyses by contractors will have adequate sensitivity. Consultation was being furnished to USATHAMA with regard to objectives for renovation of the former West Virginia Ordnance Works, the top priority "Superfund" site in West Virginia. The acute toxicities and mutagenicities of benzothiazole 1,4-oxathiane and 1,4-dithiane, environmental contaminants at Rocky Mountain Arsenal, were investigated. Determination of the subchronic toxicity of 1,4-dithiane to rats has been initiated.

LOGISTICS AND FACILITIES

The Logistics Branch had many new faces in 1985. The Chief, Property Management Officer, Biomedical Maintenance NCOIC and repairman, Equipment Records and Parts Specialist, Purchasing Agent, and Medical Supply Specialist made the turnover rate over sixty percent.

New programs were initiated and completed. Major efforts for the Test Measurement and Diagnostic Equipment program were seen throughout the Laboratory, and the Logistics Application of Automated Marking and Reading Symbols program made inventory and accountability much easier for the staff.

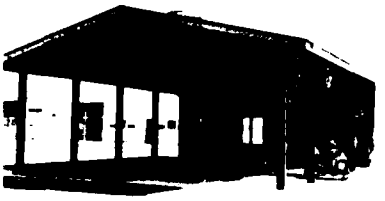
CONSTRUCTION/ALTERATION

During 1985, there were several building engineering projects designed to make better use of the existing physical plant and modernize current facilities. The renovation of Building 568, a laboratory built in 1952, continued. Completed projects included the establishment of required environmental controls in several rooms, overall upgrade of the insectaries, installation of air conditioning systems in the Aquatic Toxicology Labs, conversion of two laboratories into offices. Projects currently in progress include the renovation of several rooms and laboratories for Occupational Health Chemistry and Military Disease Hazards, a feasibility study for conversion of the Test Tank Area and installation of new energy efficient windows. The renovation of Building 568, which houses the Commander and his staff, a small element of the Health Effects Research Division, and most of the Laboratory Support Division and Field Medical Materiel Development Division, will provide better support to our scientists and engineers while performing basic and applied research and development.

Built in 1945, Building 459 is currently undergoing an architectural and engineering technical study recommended by the US Army Environmental Hygiene Agency (AEHA) and the Occupational Safety and Health Administration (OSHA). The current estimated cost of construction of an upgraded facility is 1.5 million dollars. Post Engineering Plans and Services recommended that a new laboratory be constructed. Either plan of action will enhance Health Effects Research Division's research mission of protection of industrial workers and the surrounding community and Army-controlled industry-operated munition plants.

Built in 1954 as a Research, Development, Test, and Evaluation (RDTE) Shop, Building 1054 has received new tenants; a computer system and staff from the Information Science Division, US Army Medical Research and Development Command, and the Major Support Contract Branch, US Army Medical Research Acquisition Activity. To facilitate the housing of those personnel, engineers from the Combat Casualty Care Branch and Chemical Defense Materiel Branch of the Field Medical Materiel Development Division were relocated to Building 568. New scheduled additions to Building 1054 include a new outside stairway to provide outside access to the second floor for new tenants, install a chain-link fence for security measures, renovate a washroom to better accommodate shop personnel and renovate engineers' cage storage area for Biomedical Maintenance. These additions will not alter the shop's mission of designing, fabricating and testing prototypes of field medical materiel.

Building 1059 was constructed this year as a facility for testing equipment during inclement weather and to protect personnel from noise, odors and other occupational hazards. This facility will aid significantly in developmental testing and operational engineering evaluation of medical equipment and systems.



A storage and display facility will be constructed in FY86. This building will be utilized for storage, developmental appraisal and display of foreign source medical materiel for the purpose of technological and conceptual evaluation and/or exploitation.

Renovation of Building 1215, Area B, is scheduled for FY86. As a result of a Physical Security Inspection by the US Army Health Services Command, the facility needed to be modernized in order to meet safety and security requirements for the storage of munitions. The munitions stored in the facility are used to conduct analytical methods development research, waste stream characterization and toxicity testing.

INFORMATION MANAGEMENT

During 1985, the Information Management Branch embarked on an ambitious, comprehensive acquisition program for the laboratory. During 1985, 157 line items of equipment were installed or on order to support the network of word processing, data base management, statistical analysis, data acquition, data control, general purpose scientific programming, graphics, computer aided design, and project management applications. These represent substantial improvements and will have significant impact on managers, supervisors, principal investigators, technicians, project officers, and administrators.

Statistical support was provided to eight research areas during the report year. The staff reviewed contract proposals, progress reports, final reports, consulted and participated in twenty in-house research efforts. Over one hundred written reports were rendered on 28 contracts during 1985.

INDUSTRIAL SERVICES

The Industrial Services Branch had a productive year. Twenty-eight fabrication, modeling, prototype and service order projects were completed. The industrial shop continued its program of machine tool and safety equipment modernization and acquisition. Shop personnel contributed work hours in sixteen recognized trades and thirteen associated crafts and skills. Completed prototypes included an examination chair for field optometry, an original design prototype device for collection of mosquito eggs, and a wheeled litter for patient evacuation. Models were fabricated for nine other projects which included field sterilizers, patient wraps, pesticide dispersal units, light traps for mosquito collections, and chemically hardened equipment.

TECHNICAL SERVICES

Engineering Evaluation

Equipment involved in developmental testing included two Resuscitation Devices; the Sterilizer System, Steam Vacuum Pulse, Ethylene Oxide; and the Multicapability Pesticide Dispersal Unit. Engineering evaluations, including testing, were conducted on an Aid Bag, and a Casualty Evacuation System to be used in low temperature environments.

Significant emphasis has been directed toward foreign medical equipment test and evaluation as indicated by the increase in the number of items submitted. Presently, there are ten items from the French Parachutist Surgical Unit undergoing test. During the past year a Norwegian Casualty Evacuation System was evaluated and the Israeli Aid Bag was compared to the newly type classified U.S. Army Aid Bag. The effort in foreign medical materiel exploitation will continue with a high level of enthusiasm.

A significant amount of time was spent in providing consultations in the areas of test methodology, development of test protocols, and upgrading equipment performance standards. There was participation in a number of In-Process Reviews and Test Integration Working Groups, including the Mark-II Auto Injections, Field Oxygen Generation, Sterilizers, High Capacity X-ray System, Resuscitation Devices, and the Chemical Wrap.

The test and evaluation capability was increased through the addition of a new building, providing for the ability to continue the testing of gasoline engine driven equipment during inclement weather. The structure has shelter for outside operations along with an enclosure for setting up instrumentation for monitoring various parameters. The acquisition of a Package Tester and two Digital Temperature Indicators added to the capability by increased reliability in instrumentation and equipment.

The present workload requires that the staff over extend itself to accomplish the mission in a reasonable time. This situation will be monitored to determine if additional personnel resources are required. Increased requirements for testing is likely to occur due to the interest in foreign medical equipment, ongoing field exercises, and the relationship with outside agencies.

MEMORANDUM REPORTS

Number	Title
11-84	New Chlorination Kit, Independent Evaluation
13-84	Israeli Aid Bag, Engineering Evaluation
1-85	Filter System (Burgin), DTI
2-85	Multicapability Pesticide Dispersal Unit, DTII
3-85	Sterilizer, Steam Vacuum Pulse/Ethylene Oxide System, DTII
4-85	Resuscitation Device (MSA), DTI
5-85	Resuscitation Device (Burgin), DTI
6-85	Resuscitation Device (MSA), DTI (Supplement)
7-85	HEATPAC System, Norwegian Casualty Evacuation, Engineering Evaluation
8-85	Resuscitation Device (MSA), DT (Supplement)

Technical Library

During Fiscal Year 1985, the technical library was organizationally transferred from the Information Services Branch and established as a separate section under the Technical Services Branch. Comprehensive library support services continued to be offered to the Laboratory staff, while limited service was provided to other organizations requiring access to materials held by the Bioengineering Laboratory.

An initiative has been effected to convert to microform all library journal holdings which are considered to be part of the permanent collection. A new Minolta reader-printer was purchased for the library, and the first acquisition of journals on microform should take place during 1986. Emphasis continued to be placed upon the activities of the Library Holdings Review Team, in an effort to assure that library materials reflect the relevant requirements of the research mission for scientific and technical information.

Occupational Safety and Health

The USAMBRDL continued to pursue an aggressive safety and health program during 1985. Three outside agencies inspected and surveyed the program with outstanding results. Personal protective equipment was procured, used and monitored; nine safety related work orders were initiated; special items for the handicapped were procured and installed. Of special interest was the system for obtaining and monitoring information on hazardous materials. This system served as a model for the installation and information bulletins were issued for use by other laboratories.

Research and Development Graphic Arts

The Illustration Section continued to produce quality concept drawings, illustrations, photographs and displays during 1985. Exhibits from the Laboratory were shown at several locations to support the Medical Special Program Review, poster sessions for research area presentations, and other conferences, meetings and program review sessions. The USAMBRDL staff continued to support HQ, USAMRDC projects by providing concept drawings, photographs, display fabrication and graphics consultation when requested for Command-wide programs. The work units prepared by the staff continued to draw critical acclaim by outside agencies.

VISITORS

During fiscal year 1985, the USAMBRDL received many distinguished visitors who toured the facility. The groups included DOD and DA officials, flag grade officers, foreign visitors, medical residents and student groups.

FOREIGN

7 May - MG Abdul Hameed Mohammed Al-Fraidi, Director General Medical Service Department (MSD), Ministry of Defense and Aviation (MODA), Kingdom of Saudi Arabia; BG Saleh Abdulaziz Al-Akel, Director of Training, MSD, MODA; COL Ketab Ied Al-Otiebi, Chief Surgeon, Riyadh Armed Forces Hospital; Mr. Rodney N. Hoots, Deputy Director for International Affairs, Office of the Assistant Secretary of Defense, Health Affairs

13 November - BG Samsudin, bin Hussain, Director, Medical and Dental Corps, Malaysian Armed Forces; MAJ Johan van Geyzel, Malaysian Embassy, Washington, DC

7 March - BG Dato Chen Kwee Fong, Chief of Engineers, Malaysian Armed Forces; MAJ Johan van Geyzel, Malaysian Embassy, MAJ Tairobi bin Abdul Razak, Malaysian Army

2 July - BG William O. Rodgers, Australian Army Director of Medical Services; LTC William James Kelly, Chief Pharmacist, Directorate of Australian Army Health Services; LTC Ian James Pennell, Staff Officer Operations and Plans, Directorate of Australian Army Health Service

21 November - MAJ (Dr) Zelig Tochner; CPT (Dr) Z. Ram; CPT (Dr) J. Baniel, Israeli Defense Forces Medical Service

1 October - LTC Stanislav Nikic, MAJ Dragan Ignjatovic, CPT (Dr) Slobodan Rudnjanin, Medical Officers from the Federal Secretariat of National Defense, Yugoslavia

14 December - Mr. Ingar Narvhus, Sales Manager, Standard Telefon og Kabelfabrik A/S; Mr. Tor A. Oftedal, Scientist, Norwegian Defense Research Establishment

DEPARTMENT OF ARMY, DA STAFF

9 November - Dr. Tom Welch, Deputy Assistant to Secretary of Defense

20 August - Ms. Tansill Johnson, Public Affairs Officer, Office of The Surgeon General

OTHER MACOM

6 September - COL Gerald D. Allgood, Chief of Staff; COL Robert Fields, Comptroller, US Army Health Services Command, Fort Sam Houston, Texas

18 June - COL James Bazany and Mr. James Jaksha, Deputy Chief of Staff for Operations, US Army Health Services Command

24 May - LTC(P) Jerry L. Fields, US Southern Command, Panama

26 November - Dr. J.A. Cotruvo, Director of Criteria and Standards Office of Drinking Water, US Environmental Protection Agency

STUDENTS AND RESIDENTS

24 May - Residents in Aerospace Medicine - Army: MAJ John M. Blough, MAJ Jerry W. Hope, MAJ Lester M. Lopez, MAJ Darcelle M. Delrie, CPT William E. Caldwell, CPT Winston K. Martin; Air Force: LTC Lyonio B. Nunes, MAJ George P. Taylor, MAJ Timothy G. Georgelas and CPT Christopher Heinricks

21 February - COL James E. Bagley, USA Retired and Fort Meade Senior High School students (JROTC Unit)

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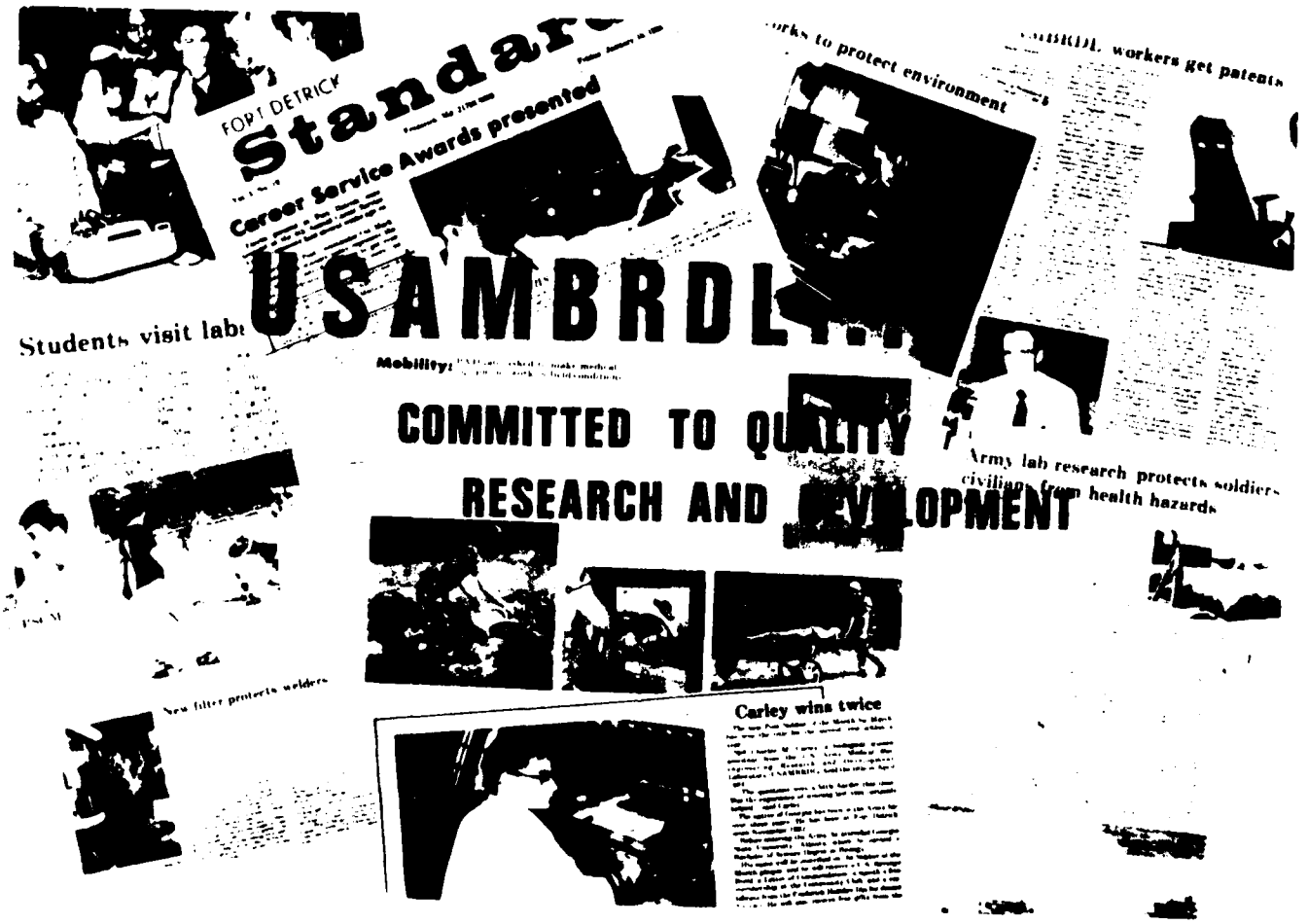

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